INTRODUCTION TO THE MAMMAL SURVEY OF THE 1965 STREET EXPEDITION TO AFGHANISTAN

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INTRODUCTION

The present paper describes the goals, organization, field work, and observations on country traversed by the 1965 W. S. and J. K. Street Expedition of the Field Museum of Natural History to Afghanistan; and is intended as an introduction for later papers on materials collected by the expedition. A brief introduction to the physiography, climate, and phytogeography of Afghanistan with a more detailed description of the habitat where we collected or observed the various species of mammals is given; followed by a narrative itinerary and gazetteer of the 15 major localities visited by our expedition. A table of the numbers and kinds of terrestrial mammals collected in each major locality is included. It is intended to use these specimens as the basis for a later, but more comprehensive faunal report on the terrestrial mammals of Afghanistan. A gazetteer of place names is included.

The primary purpose of this undertaking was to collect a geographically and ecologically representative sample of mammals from Afghanistan, including skins and skulls, but complete skeletons of some large animals and alcoholic specimens of nearly all of the small species. Extensive geographic sampling of mammal ectoparasites was a special, additional goal, important to future epidemiological problems of the country. More limited collections of reptiles, amphibians, mollusks, and plants were also obtained. The expedition was in the field from July 11, 1965 to November 22, 1965.

Expedition personnel arriving in Afghanistan from the Field Museum of Natural History included Mr. and Mrs. W. S. Street, co-leaders of the expedition; Mr. Hans Neuhauser, expedition fellow; and the author as senior expedition fellow. Other expedition personnel arriving from the American University of Beirut, Beirut, Lebanon, included Dr. Robert E. Lewis, medical entomologist, and Mr. Sana Atallah, expedition preparator. Three Afghans: a cook, cook's helper, and a driver-interpreter were hired by Mr. Street in Kabul. These nine regular members completed our party. A student from the Kabul University Agricultural School accompanied us for two weeks in July. Local hunters, guides, and camp help were engaged as needed at each major collecting locality.

Special equipment included two International Harvester Model D-1200 Travelall trucks (one having two seats, the other having four) which were especially equipped with a heavy duty chassis, 4-wheel drive, winch and power take-off, oversize tires, a kit of recommended spare parts, and a storage platform and rack the full length of the outside top (see fig. 18). Two spare tires were mounted on top of each truck. Padded canvas seats were made to fit and fasten to the hub of each spare tire. Each seat was equipped with a seat belt anchored to the roof rack. Each truck top carried eight five-gallon Jerry cans, six for gasoline, two for water. Gun racks were mounted inside each vehicle on the back of the front seat. Dr. Lewis donated the use of a Land Rover, which was also equipped with a top rack and two five-gallon Jerry cans. With these three vehicles and the generous and skilled help of representatives of International Harvester in Kabul, Mr. Street kept the expedition almost constantly mobile and able to pursue the goals we had set. To do this he also employed additional vehicles as needed and as available.

We camped throughout Afghanistan using three nine-by-nine-foot umbrella tents, three nine-by-eleven-foot wall tents and various fly arrangements. Usually Mr. Street called upon the local governor and among other things obtained permission to camp in a park in town or on a government farm where there would be trees, potable water, and sometimes grass. Generally, the hospitable local official would assign police to us day and night to fend off the friendly, curious public.

Representative ecosystems of Afghanistan were sampled by establishing a series of collecting localities, each locality unique in that it was in a geographically, topographically, and/or botanically different area. I chose the following localities and was responsible for planning the expedition itinerary; to this end I was employed by the Field Museum of Natural History in February, 1965, about five months prior to the late-June departure of expedition personnel for Afghanistan.

Study of published results of earlier field studies of Afghan physiography, climate, and vegetation, and earlier investigations of Afghan mammals enabled me to propose an itinerary. The plan was to collect samples of mammals from each of the different geobotanical regions proposed by Linchevsky and Prozorovsky (1949, p. 209) for Afghanistan and, in addition, localities of important previous mammal collections, including, especially, the type localities of mammal species or subspecies described from Afghanistan. These pro-

posed localities and expedition routes were carefully mapped in advance of field work. Since mountainous areas are cool in the summer while parts of eastern and southern Afghanistan are more habitable in the fall and winter, and because fall and winter precipitation in the mountains limits vehicle accessibility, it was decided to collect in the mountainous and northern areas during the summer and in eastern and southern Afghanistan in the fall. The ultimate itinerary thus combined the foregoing plans with field expediency.

The most rewarding methods of collecting employed by the Street Expedition included hunting, trapping, and purchasing specimens.

Hunting, by members of our party, was done mostly at night, either on foot using a six-volt headlight or by truck using two 12-volt spotlights mounted outside to the right and left of the windshield and one still more mobile 12-volt spotlight on a ten-foot cable which could be plugged into the cigar lighter and hand-held inside the truck or on the roof. This mobile light proved extremely useful. Night hunting usually started around 9:00 P.M., when it was dark enough to pick up the reflection of our light in the eyes of a mammal otherwise too distant to see. The four-passenger truck, and occasionally the two-passenger truck, with two or three collectors, would sample a predetermined area. The usual method employed was to use the four-passenger truck, the driver manipulating a spotlight mounted outside to the left, and another man on the front seat with the hand-held spotlight directed to the right. Two men with weapons rode in the back seat. Under certain conditions, such as mild weather, high roadside banks or view-obstructing vegetation, collectors would use the seats on top of the truck. Shotguns were used almost exclusively for foxes, jackals, cats, hyaenas, and hares. We often collected bats by shooting them at dusk or in the light of a spotlight. Smaller terrestrial animals, particularly jerboas and hedgehogs, were run down and netted, assuring undamaged specimens. When collected, most of the animals were immediately put into a cotton sack, which was then tied shut to entrap any ectoparasites, which otherwise frequently leave their host in response to handling or body cooling. Gazelle, ibex, and a markhor were collected by hired local hunters.

The majority of the smaller terrestrial mammals were trapped using Museum special and rat-size snap traps. To a lesser extent, steel traps, mole traps, and mist nets were employed, steel traps with least success. Mist nets, stretched across cave entrances were used to obtain series of cave-dwelling species of bats. Trapped specimens were immediately placed in cotton sacks to prevent loss or exchange

of their ectoparasites. Different habitats and altitudes were trapped around each major camp. Traps were carefully located or were marked with a reflective marker which could be easily located in the light of a flashlight. This technique has recently been described by Lewis (1967, p. 146). Traps were usually checked and retrieved while night hunting. Occasionally they were collected at dawn. This procedure reduced the amount of time the trapped animals were exposed to ants or predators and also assured a better collection of ectoparasites from each animal.

ACKNOWLEDGEMENTS

It is a pleasure to express my sincere thanks to William S. Street and his wife, Janice K. Street, who, in collaboration with the Field Museum of Natural History, are responsible for the support and successful execution of this expedition; representing their second quest for Middle Eastern mammals. In keeping with the goals of their first expedition to Iran they provided for Expedition Fellowships to enable graduate students in mammalogy to participate in and make contributions to the expedition. To this end my Fellowship was initiated six months prior to the departure of the expedition to Afghanistan and was continued for six months after the expedition's return to the Field Museum of Natural History. Our travels throughout Afghanistan were made possible by the tireless efforts of Mr. Street in gaining us access to virtually every locality on our planned itinerary. Mr. and Mrs. Street not only provided skillful leadership, but enthusiastically embraced every scientific endeavor of such an undertaking, including the collecting and preparation of many specimens.

The International Harvester Company donated one of the expedition's vehicles and, in addition, many complex logistical problems were generously and skillfully expedited by service representatives of their company in Karachi and Kabul. We are particularly grateful to Mr. Brian Reardon, whose generosity did not end with seeing that our trucks received proper maintenance: he and Mrs. Reardon extended their warm and most welcome hospitality at every opportunity.

I am especially indebted to Dr. R. E. Lewis and Mr. Sana Atallah whose willing and expert help in collecting and preparing specimens contributed much to the success of the expedition. Dr. Lewis also provided the use of a vehicle[1] and his personal collecting equipment. I also want to thank Mr. Hans Neuhauser who recorded literally thousands of fresh weights and measurements, and who is responsible for a future report on the bats collected by the expedition.

The maps are the work of Miss Marion Pahl, Staff Artist of the Field Museum of Natural History. Mrs. Dorothy Gibson, also on

[1] National Institutes of Health Grant AI–05512–01 TMP funds purchased this Land Rover for Dr. Lewis' field work on Near Eastern fleas.

the staff of the Field Museum, provided the identifications used here of the plants collected in Afghanistan. I am very appreciative of these contributions.

Gratitude is extended to Dr. Joseph Curtis Moore whose helpful advice and suggestions were much needed and appreciated, as was his skillful editing of the manuscript.

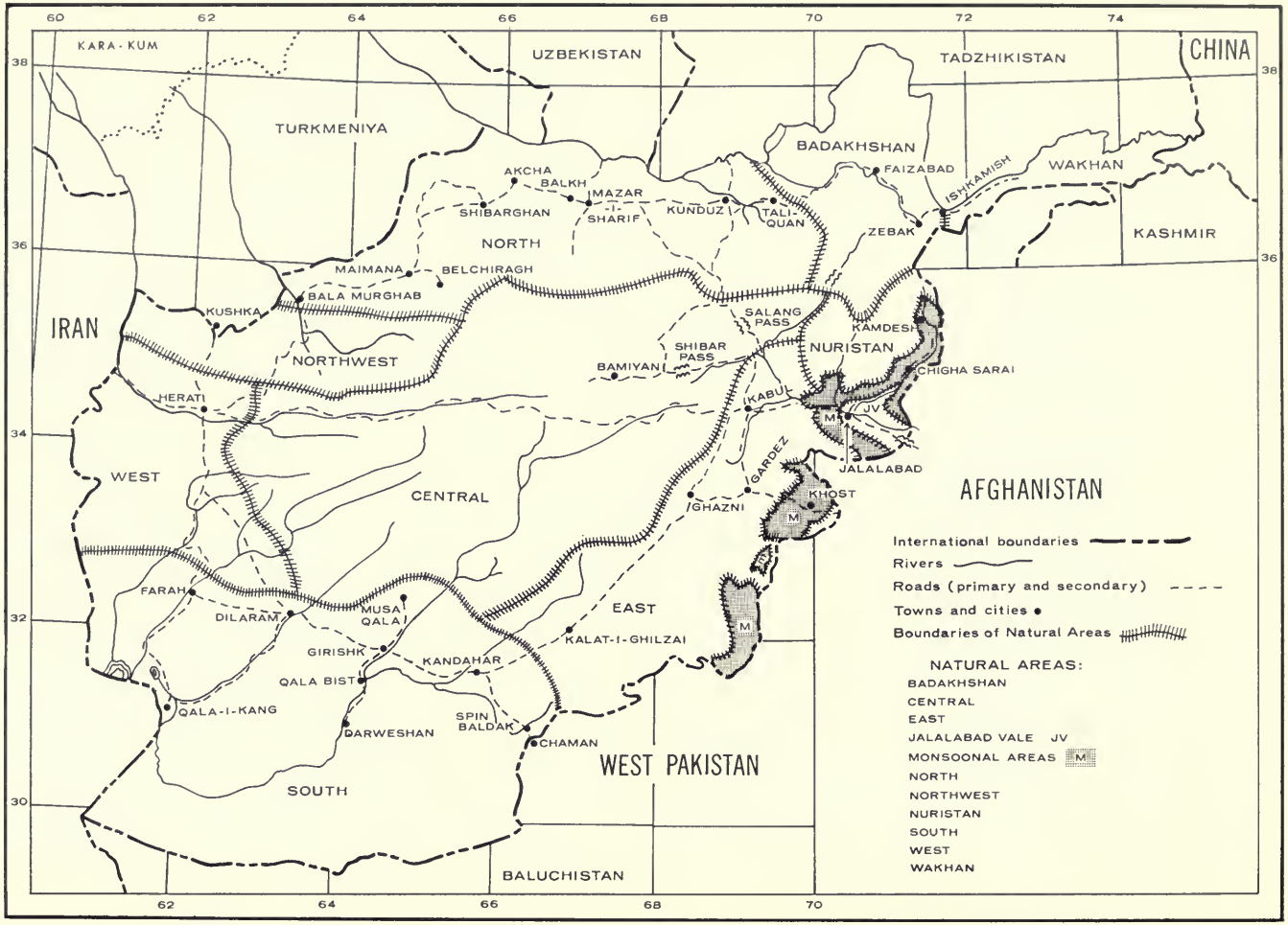
I am grateful for support by a Thomas J. Dee Fellowship of the Field Museum of Natural History during ten months (August 1966–May 1967) of the preparation of this report.

PHYSIOGRAPHY

Afghanistan lies landlocked near the middle of the Eurasian continent, between lat. 30°25′ and 38°31′ N and long. 60°45′ and 72°00′ E. A finger-like projection, the Wakhan Corridor, extends north-east to 74°51′ E. The total area of Afghanistan is about 720,000 sq. km. which approximates the size of Texas and is double the size of Great Britain and Ireland combined. Afghanistan is bounded on the north by three republics of the U.S.S.R.: Turkmeniya, Uzbekistan, and Tadjhikistan; on the northeast by the province of Sinkiang, China; on the east, south, and southwest by Kashmir and West Pakistan; and on the west by Iran (Persia). Figure 1 illustrates these geographic relationships, and also shows Humlum's (1959, map, p. 103) subdivision of Afghanistan into "natural regions"; each region being based upon a correlation of climatology and orography. These regions, when referred to in this paper, will be capitalized.

Part of Afghanistan with the province of Baluchistan in West Pakistan makes up the eastern part of the Iranian Plateau. This mountain-rimmed plateau rises between the valleys of the Indus River in the east, the Tigris River in the west, the Oxus River (Amu Darya) to the north, and ends along the Persian and Oman gulfs and the Arabian Sea on the south. The most northwestern extension of the Iranian Plateau is represented by the Caucasus Mountains. The Paropamisus and Hindu Kush ranges, mountains of central and northern Afghanistan, link the plateau with the Pamirs to the northeast and the Himalayas to the east (see fig. 2). The natural region designated North Afghanistan (see fig. 1), which lies north of the Hindu Kush and south of the Oxus River, is a continuation of the Central Asian steppe, or the Kara Kum Basin as illustrated by Gansseer (1964, plate 1, part B).

Afghanistan is characterized by three major topographical regions, each diagrammatically illustrated in Figure 2. These regions, in order of diminishing altitude, are: 1) the centrally-located Hindu Kush mountain range with a NE–SW axis, and its auxiliary ranges, the Paropamisus and Koh-i-Baba; 2) the generally barren and rugged foothills of these ranges giving rise to more peripheral, gently-sloping alluvial fans and steppes; and 3) the lower steppes and deserts.


AFGHANISTAN
KARA-KUM
UZBEKISTAN
TADZHIKISTAN
CHINA
TURKMENIYA
BADAKHSHAN
FAIZABAD
ISHKAMISH
WAKHAN
KASHMIR
AKCHA
BALKH
MAZAR-I-SHARIF
SHIBARGHAN
KUNDUZ
TALI-QUAN
ZEBAK
NORTH
MAIMANA
BELCHIRAGH
BALA MURGHAB
KUSHKA
IRAN
NORTHWEST
SALANG PASS
SHIBAR PASS
BAMIYAN
NURISTAN
KAMDESH
CHIGHA SARAI
HERATI
KABUL
JV
M
JALALABAD
GARDEZ
WEST
CENTRAL
GHAZNI
KHOST
FARAH
DILARAM
MUSA QALA
EAST
KALAT-I-GHILZAI
GIRISHK
KANDAHAR
QALA BIST
QALA-I-KANG
SPIN BALDAK
DARWESHAN
CHAMAN
WEST PAKISTAN
SOUTH
BALUCHISTAN
International boundaries
Rivers
Roads (primary and secondary)
Towns and cities
Boundaries of Natural Areas
NATURAL AREAS:
BADAKHSHAN
CENTRAL
EAST
JALALABAD VALE JV
MONSOONAL AREAS M
NORTH
NORTHWEST
NURISTAN
SOUTH
WEST
WAKHAN
60
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74
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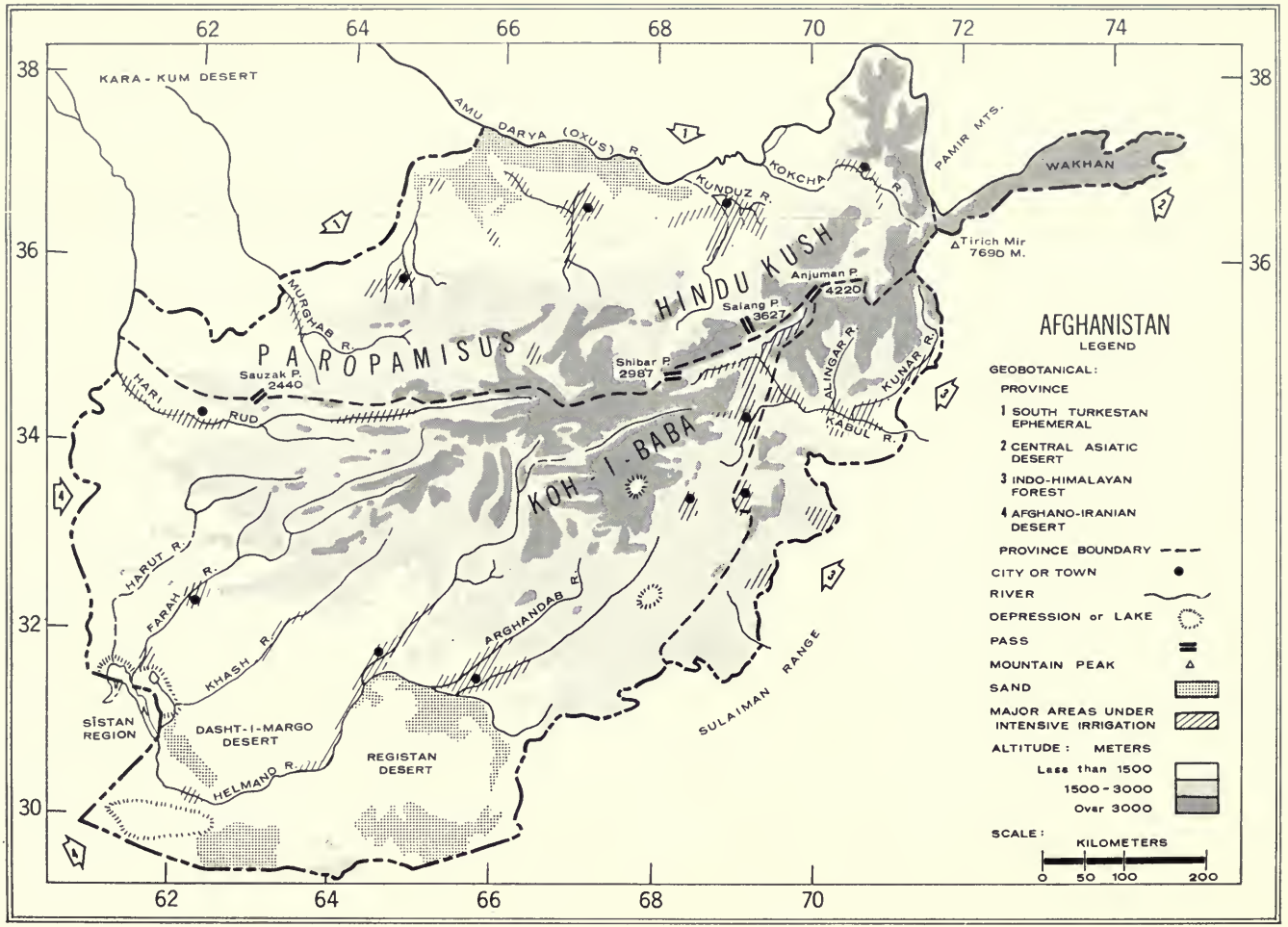
The highest mountains of Afghanistan occur in the Wakhan, immediately south of an orographic region frequently referred to as the Pamir Knot. From this region mountains radiate fanwise southwestward, gradually decreasing in height to the peripheral steppes and deserts of North, Northwest, West, South, and Southeast Afghanistan. The general elevation of the Hindu Kush mountain range declines from 7690 m. (Tirich Mir) near the west end of the Wakhan Corridor to the Salang Pass (3627 m.) north of Kabul and disappears between 500 and 1000 m. in the northwest and in the low plains and deserts of the southwest. The Hindu Kush proper descends from the Wakhan Corridor and forks off to the west as the 1000 to 4000 m. Paropamisus range separating the Hari Rud from the Murghab Valley and ending in northwestern Afghanistan near the Iranian border. The Koh-i-Baba range, with several spurs, and with peaks as high as 5090 m., is a continuation of the Hindu Kush in Central Afghanistan.

The large Helmand River and the smaller Khash, Farah, and Harut rivers of south and southwestern Afghanistan have no outlet to the sea. They flow to the southwest desert depression of a former lake bed known as the Sistan, which extends across the Afghan-Iranian border. The Murghab and the Hari Rud, with headwaters in the Paropamisus and Koh-i-Baba ranges respectively, are the largest rivers rising in northwestern Afghanistan and end in the sands of the Kara Kum Desert within Turkmeniya. The Oxus River demarks Afghanistan's northern boundary for approximately 1150 km. It originates in the high mountains of the Wakhan region and eventually empties into the Aral Sea in Uzbekistan. The Kunduz River in North Afghanistan and the Kokcha River in Badakhshan, unlike other rivers of this area which are completely consumed in the irrigation of the land, empty into the Amu Darya. The Kabul, Alingar, and Kunar rivers, and their tributaries drain an orographically-complicated series of mountains in Nuristan, Monsoonal and north East Afghanistan. The highest elevations of these mountains range from 4755 m. in the Safed Koh Range, which is south and southeast of Jalalabad, to 5425 m. near the headwaters of the Alingar and Kunar rivers in Nuristan. These two rivers join the Kabul River, which flows to the southeast and empties into the Indus in West Pakistan.

FIG. 1. The natural areas and geographic relationships of Afghanistan.


62
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KARA-KUM DESERT
AMU DARYA (OXUS) R.
KUNDUZ R.
KOKCHA R.
PAMIR MTS.
WAKHAN
Tirich Mir
7690 M.
HINDU KUSH
Anjuman P.
4220
Salang P.
3627
Shibar P.
2987
MURGHAB R.
PAROPAMISUS
Sauzak P.
2440
HARI RUD
ALINGAR R.
KUNAR R.
KABUL R.
KOH-I-BABA
HARUT R.
FARAH R.
KHASH R.
ARGHANDAB R.
SULAIMAN RANGE
SISTAN REGION
DASHT-I-MARGO DESERT
REGISTAN DESERT
HELMAND R.
AFGHANISTAN
LEGEND
GEOBOTANICAL:
PROVINCE
1 SOUTH TURKESTAN EPHEMERAL
2 CENTRAL ASIATIC DESERT
3 INDO-HIMALAYAN FOREST
4 AFGHANO-IRANIAN DESERT
PROVINCE BOUNDARY
CITY OR TOWN
RIVER
DEPRESSION or LAKE
PASS
MOUNTAIN PEAK
SAND
MAJOR AREAS UNDER INTENSIVE IRRIGATION
ALTITUDE: METERS
Less than 1500
1500-3000
Over 3000
SCALE:
KILOMETERS
0 50 100 200

CLIMATE

Reliable data on the climate of Afghanistan is scarce, since prior to 1939 weather was only recorded in Kabul. Eight additional meteorological stations were established between 1939 and 1943, under the direction of E. Stenz. Using data obtained from these stations and from adjacent observatories in Russia and India, Stenz (1946, pp. 1–14; 1957, pp. 245–266) describes the main climatic features of Afghanistan, particularly its precipitation, evaporation, and aridity.

Afghanistan is an arid country having a continental climate, the latter being reflected by intense and rapid daily and seasonal temperature variations. The magnitude of these characteristics appears to be influenced by five factors as follows:

1) High plateaus in East Afghanistan and high mountains, the latter, especially in the Wakhan region, having permanent ice and snow.
2) The extent of Indian monsoons, which according to Stenz (1946, p. 3) may reach to 30 km. west of Kabul.
3) Desiccating winds such as the "hot and dry wind of 120 days" that blows between May and September from the area of Herat across the Sistan basin.
4) The Kara Kum, Jalalabad, and Sistan basins, which by virtue of their locations and low elevation (less than 1000 m.) have scant and sporadic rainfall (0–250 mm. per year), a mean January temperature above freezing and a mean July temperature above 32°C. (Humlum, 1959, pp. 57, 59, 61).
5) Riparian vegetation and oases, which according to Borisov (1965, p. 179) commenting on oases characteristic of those found in the deserts of Central Asia, including those of North Afghanistan, at the height of the summer can have ambient temperatures three degrees C° cooler than those recorded in the surrounding deserts.

Temperature: The yearly mean temperature at Kabul (1790 m., 13-year record) is 11.5°C with a mean maximum of 19.6°C and a

FIG. 2. Major natural features of Afghanistan and the geobotanical provinces of Linchevsky and Prozorovsky (1949).

mean minimum of 3.8°C (Stenz, 1946, p. 1). Stenz (1946, p. 1) remarks: "The continental character of the annual course of temperature at Kabul is conspicuous; the absolute limits of variation are so far 37.7°C and −25.8°C, thus the range being 63.5°C. Corresponding range for mean monthly temperature is 27.4°C."

Humlum (1959, pp. 57, 59) provides isothermal maps. These maps are approximations based on the best available information. Mean January and July temperatures, as illustrated by Humlum are, respectively, for South Afghanistan above +6°C, and above 32°C; for the foothills and plateaus most of which are found between 1500 and 3000 m. (see fig. 2) +6°C to −6°C and 23°C to 32°C; and for the higher mountain massifs below −6°C and below 23°C. The coldest temperatures will be found in the Wakhan region at high elevations. Stenz (1946, p. 2) lists −17.2°C as the mean temperature for the coldest month of the year recorded at a Russian station, Pamirski Post (38°11′N, 74°02′E, 3653 m.) immediately north of the Wakhan. North and South Afghanistan are almost equally hot. The warmest month recorded at Girishk (31°50′N, 64°35′E, 945 m.) was 33°C (Stenz, 1946, p. 2), while Borisov (1965, p. 179) gives 32°C as the mean July 1965 temperature recorded at Termez, U.S.S.R. (37°13′N, 67°15′E, 302 m.) on Afghanistan's northern border.

Stenz (1957, p. 260) expresses the thermal continentality of Afghanistan on a scale, the zero per cent of which corresponds to a purely oceanic climate, and the 100 per cent to the most continental climate in the world at Werkhoiansk in northeast Siberia. He calculates that Kabul, as well as South and West Afghanistan, shows about 60 per cent while the high plateaus in the East, excluding Kabul, show 70 per cent continentality. On the other hand, Stenz shows Jalalabad as having 50 per cent continentality, while Parachinar (south of Jalalabad in W. Pakistan) is even lower with 41 per cent. From the foregoing, Stenz concludes that Monsoonal Afghanistan and the Jalalabad Vale: ". . . is a transitive region between the main Afghan area and India where the continentality is less."

The continentality of Afghanistan is exemplified by records kept by the Street Expedition. We operated a (model 61 5C Pandux) one-week, continuously recording thermometer in an aerated, shady location at each camp. The mean daily temperature variation for 53 days in the field between July 12 and November 22 was 18.3°C.

Precipitation: The mean yearly precipitation given by Stenz (1946 p. 2) is: for Kabul 300 mm. (16-year record); Jalalabad 185 mm' (three years); Kandahar 192 mm. (five years); and Herat 201 mm·

(four years). The smallest mean annual precipitation of 40 mm. (Mushkichah, 29°01′N, 62°26′E, seven-year record) and 53 mm. (Nastratabad, 31°01′N, 61°30′E, 25-year record) was recorded in the Sistan Basin. Humlum (1959, p. 61) illustrates Monsoonal Afghanistan as having a mean annual rainfall in excess of 400 mm. Stenz (1946, p. 2) shows a mean of 750 mm. per annum for a 25-year record kept at a weather station in West Pakistan, but near the border of south Monsoonal Afghanistan, almost 19 times as much precipitation as recorded farther west in the Sistan.

Humlum (1959, p. 61) provides a map of approximate precipitation zones. South, West, Northwest, and North Afghanistan, the Wakhan and the Jalalabad Vale receive a mean annual precipitation of less than 200 mm.; the mountains and plateaus of Badakhshan, Central Afghanistan, East Afghanistan, and Nuristan get from 200 to 400 mm. per year; while parts of Nuristan, the Paghman mountains due west of Kabul, and Monsoonal Afghanistan may receive a mean annual precipitation in excess of 400 mm.

According to Stenz (1946, pp. 4–10), the effect of precipitation on soil moisture and vegetation in this dry country is chiefly governed by evaporation. A map by Borisov (1965, p. 69), of evaporation potentials for the Soviet Provinces abutting Afghanistan suggests that the Wakhan with a mean annual precipitation of less than 200 mm. will have an annual potential evaporation near 500 mm., while Northwest Afghanistan with 200 mm. of rain per year has an annual potential evaporation near 2000 mm. The smaller amount of precipitation in the Wakhan would be more effective on soil moisture and vegetation.

Climatic Divisions: Stenz (1946) reviews the climatic divisions of Afghanistan as proposed by Köppen (1931), Thornwaite (1933), and Trewartha (1943) on their generalized climatic maps of the world and the more specific divisions as proposed by Vavilov and Bukinich (1929, pp. 536, 537). He concludes that climatic divisions differ more or less according to various authors but one trait is common, namely, all the authors stress the variety of climates and distinguish from three to six climatic zones. The approximative nature of these zones and their vague boundaries serve only to emphasize the lack of systematic weather records. Stenz (1946, p. 12) gives another climatic map which, like its predecessors, ". . . is rough and approximate." Nevertheless, it appears to show some agreement with geobotanical maps and is considerably more refined than previous maps.

Stenz (1946, p. 4) cites an equation for determining an aridity factor, the upper (dry) limit of which is 100 per cent, while the zero represents an extremely wet climate. He comments that this factor, "... being based on the temperature range, precipitation and latitude expresses the combined effect of thermal continentality and rainfall variability."

Afghanistan has desert, steppe, moderate, and extreme climatic zones, according to Stenz (1946, pp. 11–13). The desert zone (or the semi-arid, subtropical desert with dry summers of Thornwaite, 1933, and Trewartha, 1943), which Stenz defines as having the mean temperature of the coldest month *above* −5°C and over 40 per cent aridity, is found in South and West Afghanistan.

The steppe climate zone is characterized by 20 to 40 per cent aridity and a mean temperature in the coldest month *above* −5°C; this is illustrated as occurring adjacent to the foothills of South and West Afghanistan, and in Northwest and North Afghanistan. The Jalalabad Vale has a steppe climate, but with an especially mild winter. The mean temperature in the coldest month is *above* 8°C. The extreme climate of Stenz's system occurs in East and Central Afghanistan, Badakhshan, Nuristan, and the Wakhan. This zone, irrespective of aridity, has a mean temperature in the coldest month *below* −5°C and in the warmest month *above* 10°C. The moderate climate of Stenz characterizes Monsoonal regions, the Kunduz Valley, and the Kabul and Kunar River valleys with aridity less than 20 per cent and the temperature in the coldest month *above* −5°C. A border strip of Monsoonal Afghanistan also has a moderate climate, but with the coldest month's temperature *above* 0°C.

POPULATION

The majority of Afghanistan's population is concentrated on a series of oases, which are peripheral to the central mountain massifs. There has not yet been a door-to-door census, but Wilber (1962a, p. 33), in a critical analysis of published estimates, suggests that nine million people would be a reasonable estimate. This figure includes two million nomads and an urban population of about 900,000. According to Wilber, "... no official rural-urban breakdown is available, and the reliability of figures on the towns and larger villages is very doubtful. Assuming an urban population of 900,000, i.e., one-tenth of the total, it can be estimated that Kabul now holds some 250,000 people. The urban centers fall into the general groups: towns of probably more than 75,000 people (Kabul, Kandahar, Herat, Mazar-i-Sharif); towns estimated to be between 25,000 and 75,000 (Andkhui, Jalalabad, Maimana, Tashqurghan); and some 15 or 20 towns of about 10,000 people."

The people of Afghanistan have a variety of ethnic backgrounds. The largest groups are the Pushtuns (speaking Pushtu, an Indo-Iranian language), which appear to number over half of the total population; the Tajiks (speaking Persian), about a third; and the Uzbeks and Turkomans (speaking Turkic languages), about an eighth (Wilber, 1962a, pp. 34 and 36–65). In 1936 Pushtu was declared the official language of Afghanistan. Pushtu, like Persian, is written in the Arabic alphabet but utilizes additional letters.

A detailed description of the people, society, and culture of Afghanistan is given by Wilber (1962a), who represents his work as, "... a collation and synthesis of the best and most authoritative materials available on the country, including foreign and unpublished information." Wilber (1962b) has also compiled an *Annotated Bibliography of Afghanistan* which may supply the student beginning research on virtually any Afghan subject with access to existing, related knowledge.

PHYTOGEOGRAPHY

The arrangement of categories in the following phytogeographical treatment is my own. However, comments on the kinds of vegetation and where it is found are, with only those exceptions identified as such, drawn from the works of Linchevsky and Prozorovsky (1949, pp. 179–214) and Kitamura (1960, pp. 1–18). The present author's phytoecological observations, with lists of plants collected by the expedition, are given in the next section titled: MAMMAL HABITAT.

Vegetation is divided into three broad topographical divisions according to elevations, which are in order of descending altitude as follows: Montane Vegetation above 3000 m.; Montane Vegetation from 1500 to 3000 m., and Steppe and Semi-desert Vegetation below 1500 m. Figure 2 illustrates the elevational divisions used in the present paper and the geobotanical provinces of Linchevsky and Prozorovsky (1949).

I observed, that, exclusive of irrigated oases and the local forests of conifers and evergreen oaks in Monsoonal Afghanistan, the vegetation to be exceedingly scant and xerophytic, reflecting not only the continental nature of this country's climate, but also its varied topography and substrate.

According to Linchevsky and Prozorovsky (1949, p. 185) the soils of Afghanistan consist mostly of sierozyoms[1] distinguished by low humus (1 – 3%) and high carbonate content. Except for the loess foothills of North Afghanistan, I observed the mountains, valleys, and alluvial fans to be mostly covered with superficial deposits of rock and coarse gravel; organic detritus was negligible and soil was generally hard packed or feebly developed. Areas of poor drainage and high evaporation, such as the Helmand Basin, river valleys and oases, had solanchak soils that typically supported salt tolerant species of Chenopodiaceae. In local areas of northern and southwestern Afghanistan, we skirted sand dunes while driving on deserts of hardpan clay, or "pebbles" (=alluvium derived from nearby mountains).

[1] Sierozyom soils are pedocals (=arid soils) or gray soils of cool to temperate arid regions, usually under shrub and grass vegetation.

The greatest differences in vegetation due to local variations in topography seem to be associated with ground moisture and slope. In the montane forests of eastern Afghanistan that receive moisture from the Indian monsoons, hillside depressions and valleys have more vegetation than adjacent higher areas with more rapid run-off. Sauzak Kotal (=pass) in the northwest had juniper trees on north-facing slopes, but was relatively treeless on the south-facing slopes. Hilltops and deep ravines often lacked vegetation, apparently because of the erosive action of wind and water.

Montane Vegetation Above 3000 Meters: According to Humlum (1959, p. 17), East Afghanistan, Nuristan, Badakhshan, Wakhan, and Central Afghanistan have respectively 2.2, 40.8, 27.5, 82.9, and 24.1 per cent of their total land masses above 3000 m. or a total of 10.5 per cent of Afghanistan is found above 3000 m.[1]

Eyre (1963, map 3) considers the high montane regions in Afghanistan to be covered with a climatic climax of alpine vegetation.

The following comments are mainly drawn from Linchevsky and Prozorovsky's (1949, pp. 179–214) and Kitamura's (1960, pp. 1–18) treatment of vegetation found above 3000 m.

Alpine and sub-alpine areas are generally dry having a preponderance of drought-resistant vegetation on stony soils. The vegetation of these cold deserts is chiefly wormwood, *Artemisia*, and teresken, *Eurotia*, sometimes with a proportionately large amount of steppe grasses of the genera *Fescue* and *Stipa*. Dense hemispherical clumps (=tragacanth vegetation) of *Acantholimon*, *Astragalus*, and spiny *Cousinia*, often interspersed with low sedge meadows of *Atropis* and *Cobresia*, are common. Scattered through these cold, desert communities are shrubs of the genera *Berberis*, *Rosa*, and *Ephedra* and forbs such as *Polygonum affine*, *Anphalis contorta*, and *Trigonella griffithii*. The annual herb *Potentilla* and the large umbellifer *Ferula* are found in dry, rocky terrain. Drier slopes, especially south-facing slopes, have few trees, the herbaceous vegetation being sparse or absent. *Juniperus seravschanica* or *J. communis* occur on such slopes, often depressed and covering the ground with many branches.

In Nuristan little or no vegetation is found in regions with permanent ice and snow, usually above 3500 m. Lower, in areas with sufficient subsurface soil moisture one finds copses of scrub willow, juniper, or the popular, *Populus nigra*. Shrubs such as *Rosa webbi-*

[1] Humlum considers the highest elevation in Monsoonal Afghanistan to be below 3000 m.; however, coniferous woodlands characteristic of this natural area extend above 3000 m.

ana and *Polygonum glaberrium* may form dense thickets along streams. Monsoonal Afghanistan supports at least seven conifers. The moist coniferous understory contains many shrubs and small trees such as *Astragalus, Rhododendron, Ribes, Lonicera,* and *Prunus.* Below 3200 m. Paludan (1959, p. 27) describes *Pinus excelsa, Abies webbiana,* and *Picea morinda* from moist, northwest facing slopes. Drier southeast slopes had *Cedrus deodora* and *Pinus gerardiana.* Immediately above these forests, junipers, *Juniperus polycarpos* and *J. communis,* occupy a narrow belt of 200 m. This belt is commonly found between 3000 and 3400 m. Scattered between the trees and shrubs and on slopes and plateaus with sufficient humidity are species of *Poa, Atropis, Elymus, Alopecurus, Carex, Juncus, Scirpus,* and numerous forbs—e.g., *Oxytropis, Potentilla, Cerastium, Draba, Delphinium,* and *Rheum.* Wet meadows may have the low sedge *Cobresia* covering the ground with a continuous sod.

Montane Vegetation From 1500 to 3000 Meters: Humlum (1959, p. 17) gives no figures for the zone 1500 to 3000 m. comparable to those given for areas above 3000 m.; however, an idea of the approximate area involved can be seen when Humlum's figures for elevations between 1800 and 3000 m. are examined. For this zone, North, East, South, West, Northwest, and Central Afghanistan, Monsoonal Afghanistan, Nuristan, Wakhan, and Badakhshan have respectively 16.3, 82.3, 0.3, 3.0, 29.7, 59.8, 20.4, 41.4, 17.1, and 36.2 per cent of their land masses encompassed by these elevations, or a total of 33.1 per cent of Afghanistan is found between 1800 and 3000 m. The figure for the zone from 1500 to 3000 m. would very likely be close to 40 per cent.

Eyre (1963, map 3) postulates that within the boundaries encompassed by these altitudes the following three major plant communities are in a stable equiliberium with climate and soil: 1) Semi-desert Shrub, 2) Deciduous Summer Forest, and 3) Tropical Montane Forests with conifers.

The semi-desert shrub is encompassed by the South Turkestan Ephemeral Province and the Afghan–Iran Desert Province shown in Figure 2. Plant communities within the semi-desert scrub contain medium herbage, semi-shrub, and shrub vegetation with steppe meadows and some trees. Some ecological dominants of these communities are: wormwood, species of *Artemisia*; teresken, *Eurotia* sp.; tragacanthoid, *Acantholimon* sp. and *Cousinia*; the saltwort, *Salsola* sp.; the umbellifer, *Ferula* sp.; *Carex* spp.; *Stipa* spp.; and trees such as pistachio, *Pistacia vera.*

Eyre confines the deciduous summer forest community to the northern slopes of the Hindu Kush–Paropamisus mountain ranges. The following comments taken from the treatment of this vegetation by Linchevsky and Prozorovsky (1949) and Agakhanyants *et al.* (1963, pp. 100–103) indicate that it is not a forest as such, but more typically an admixture of open woodland and semi-desert scrub. This community is limited to the southern edge of the South Turkestan Ephemeral Province. At elevations around 1500 m. medium herbage and semi-shrubs with patches of ephemeral vegetation are dispersed over south-facing slopes. At 1500 m. scattered *Pistacia vera* are found on an *Artemisia, Artemisia-Salsola, Artemisia-Carex,* and tall grass steppe. *Artemisia* deserts with a mixture of *Hammada leptoclada, Mepeta,* and *Ziziphora* sp. were found above 2000 m.; *Acantholimon, Acanthophyllum,* and *Ephedra* appeared at 2700 m. Trees living on north-facing slopes near 1500 m. may include *Juniperus seravschanica, Juglans* sp., *Fraxinus,* and *Acer* sp. Species of willows, *Salix* spp., and poplars, *Populus* sp., grow along river and stream banks.

Steppe and Semi-Desert Vegetation Below 1500 Meters: According to Humlum (1959) 56.4 per cent of Afghanistan is found below 1800 m., or about 50.0 per cent will be found below 1500 m. Its distribution, as given by Humlum for terrain below 1800 m., is respectively 83.7, 15.5, 99.7, 97.0, 70.3, 16.1, and 79.6 per cent for North, East, South, West, Northwest, Central, and Monsoonal Afghanistan, and 17.8, 36.2, and 0.0 per cent for Nuristan, Badakhshan, and Wakhan. I have separated the Jalalabad Vale from Monsoonal Afghanistan. All of the Jalalabad Vale is found below 1800 m.; therefore, the 79.6 per cent given for Monsoonal Afghanistan is considered to be high.

Much of the land below 1500 m. consists of wide valleys and expansive semi-deserts. Most of the irrigated land and many large oases are located in this zone.

Parts of Eyre's (1963) Semi-Desert Scrub, Deciduous Summer Forest, and Tropical Montane Forest with conifers are also found in this zone. However, for elevations near 500 m. two new formations are given. At this low altitude the Semi-Desert Scrub is replaced by climatic climax formations of Desert Vegetation and Tropical-Desert Scrub, which are limited respectively to a narrow strip along the border of North Afghanistan and to extreme southwestern Afghanistan.

The South Turkestan Ephemeral Province (fig. 2) is distinguished by a zone of ephemeral sedge-meadow-grass vegetation below 600 m., on a belt of coarse shrub-sedge-meadow-grass vegetation and pistachio communities 600 to 1100 m., and a zone of medium-herb, perennial vegetation with pistachio and scrub communities from 900 to 1800 m. In this same province Agakhanyants *et al.* (1963) describe belts of vegetation from near Puli-Khumri and Kunduz: ". . . the Afghanistan–Turkestan type, also characteristic of South Tadzhikistan has foothills and lowlands with short grass semi-savannas and associations including *Hordeum leporinum, Thaeniatherum crinitum, Aegilops squarrosa, Lagonychium farctum,* and *Hammado leptoclada,* 400–800 m.; desert associations of *H. leptoclada* with *Peganum harmala,* and higher *Artemisia maritima* with an admixture of *H. leptoclada* and *Carex pachystylis,* 650–1300 m.; and *Pistacia vera* on an *Artemisia, Artemisia-Salsola, Artemisia-Carex,* and tall grass semi-savanna higher than 1300 m." Kitamura (1960, p. 8) sampled a hill near Kunduz and found: ". . . the vegetation was very sparse composed of the following grasses and herbs: *Hordium leporinum, Diarthron vesiculosum, Phlomis olga, Heliotropium lasiocarpium,* and *Peganum harmala.*" From the same zone, 1200–1400 m., he describes steppe grasses: "*Sorghum halepinse, Echinochloa crusgalli, Lolium loliaceum, Pennisetum dichotomum,* plus *Aeluropus littoralis* from saline soils and *Cynodon dactylon* on loess hills."

The Afghan–Iranian Desert Province (fig. 2) is characterized by a zone below 1200 m. with a predominance of semi-shrubby vegetation, notably pure *Artemisia* and *Salsola* communities occupying the plains and foothills, semi-shrubs and bunch grasses on sand, and meadows and tree-shrub vegetation in the river valleys where there is a high level of sub-soil water. Near 1000 m. there is a preponderance of ephemeral *Artemisia* and *Stipa-Artemisia* desert communities principally on the rubbly slopes of medium and low altitude mountains. Kitamura (1960, p. 7) describes the herbs *Peganum harmala, Zygophyllum fabago, Heliotropium lasiocarpum,* and the spinous shrub *Prosopis stephaniana* from a roadside near Kandahar. Additionally: "*Citrullus colocynthus* was found in sandy places. *Artemisia maritima* is widely distributed, usually covering the mountain slopes on saline soils. Other chenopodiaceous plants forming communities in this zone are *Halocharis violacia, Suaeda salsa, Salsola kali* and an endemic of Afghanistan *Halarchon vesiculosus.* On a plain north of Kalat-i-Ghilzai, *Artemisia maritima* and *Launaea tomentella* were dominant, mixed with *Linaria peganum, Othonnopsis* and *Astragalus.* The plants stand 1 to 2 m. apart."

The Indo-Himalayan Forest Province is characterized below 1200 m. by a zone of sub-tropical steppes and deserts, commonly with grass communities and thickets of sub-tropical shrubs. Above 1200 m. oak woods with varying amounts of undergrowth constitute a zone of scrub and deciduous woodland. The Jalalabad Vale is, in part, drier than most of this zone. Here, around 500 m., spiny *Acacia modesta*, and succulent *Calotropis procera* are characteristic shrubs. *Withania coagrans* and Apocyaceous *Rhazia stricta* grow on rocky terrain. Scattered communities of *Artemisia maritima* occur on mountain slopes. Near Chigha-Sarai *Cannabis sativa* was abundant. North of Chigha-Sarai along the Pech River, between 820 and 1020 m., the vegetation is sparse and composed of dwarf shrubs—e.g., *Dodonaea*, *Daphne*, *Nerium*, and *Kótschyi*. Stony terraces along the river had pomegranate communities, *Puncia granatum*, and *Zizyphus jujuba*. On rubbly soils *Rumex hastatus* was dominant with an admixture of *Cirsium*, *Erigeron*, *Aster*, *Potentilla*, and *Bupleurum*. Above 1020 m. the southeast slopes of mountains were covered with *Quercus baloot*. At the lowest elevations, around 1020 m., it appeared sparsely as a dwarf shrub; higher, it increased in number and size. Some slopes had a continuous covering of these trees. *Olea*, *Pistacia*, *Ficus*, *Zizyphus*, and *Puncia* appeared intermittently among the oaks. Among rocks scrub communities of *Sageretia*, *Daphne*, *Indigofera*, and *Cotoneaster* were found. Scrubby *Spiraea tomentosa* and *Rosa webbiana* were abundant. Riverine meadows contained many genera of herbs, for example, *Polygonum*, *Geranium*, *Clematis*, *Astragalus*, and *Impatiens*. In drier meadows genera of Gramineae, i.e., *Saccharum*, *Chrysopogon*, *Pennisetum*, *Apluda*, and *Thyrsia*, may predominate. *Ferula jaeschkiana*, a tall umbellifer, is distributed throughout Nuristan. On rocks, clumps of drought-resistant herbs such as *Bupleurum*, *Campanula*, *Erigeron*, *Astragalus*, *Cousinia*, and *Viola* were growing. Some mosses and ferns were observed in the more humid environments.

MAMMAL HABITAT

In the present paper interest in vegetation is strictly limited to what the vegetation contributes to the mammalian habitat and to what extent it may influence or correlate with the distribution of mammal species. It seems to me that the phytogeography depicted by the authors quoted in the foregoing section is not based upon sufficient sampling or original field observations in Afghanistan to provide adequately natural subdivisions to which to compare our evidence on Afghan mammal distribution. With this in mind it was decided to characterize the *topography, substrate,* and *vegetation,* so as to furnish comparative data of this kind on the places where we collected and observed the various species of mammals. These characteristics, either alone or combined, may represent distinguishable ecosystems, any of which may harbor species of mammals locally restricted to it. I am calling these areas biotopes.

The most obvious factor determining the local differences between habitats in Afghanistan is water. Dry habitat in different geographic regions of Afghanistan resemble each other more than wet habitat resembles dry in the same geographic region. The greatest contrasts in the nature of habitat are seen when one compares anthropogenic habitat[1] with non-anthropogenic habitat, montane areas in Monsoonal Afghanistan with arid mountain areas, or mountains with deserts. It follows that a broad classification of habitats and a more specific delineation of biotopes having different water regimes, substrate and/or topography associated with different kinds and/or amounts of vegetation is needed, especially with respect to the ecology of mammals. A quantified classification of the physiognomy and density of vegetation is desirable, and the following system will be used:

Density—Low: less than one plant per 4 sq. m.; Medium: one to 16 plants per 4 sq. m.; High: more than 16 plants per 4 sq. m.

[1] Anthropogenic habitat is any habitat induced or altered by the presence and activities of man. This kind of habitat is superimposed upon the natural habitat of Afghanistan. There are degrees of anthropogeny, the highest being found in urban areas, the lowest in high mountains and dry deserts. Mammals found only in habitat with a high degree of anthropogeny will be termed synanthropes (with man) or synanthropic mammals.

Shade—Low: less than 25 per cent of the ground shaded at noon; Medium: from 25 to 75 per cent of the ground shaded at noon; High: more than 75 per cent of the ground shaded at noon.

Strata—One: plants all rising but little above ground level, usually herbs and grasses; Two: two levels of height attained by plants, usually herbs and higher shrubs, but also other combinations; Three: three levels attained by different types of plants, usually herbs, shrubs, and trees.

Distribution—Clumped: clumps of vegetation in representative 25 sq. m. plot separated by strips and patches of barren soil; Even: vegetation in representative 25 sq. m. plot evenly distributed; Irregular: vegetation clumped and evenly distributed.

Homogeneity [This term is used to delineate the size and uniformity of the particular vegetation association being described. For example, vegetation along a river bank or within many oases is usually characterized by "low homogeneity" because less than 500 m. beyond the river or oasis the soil will be drier supporting vegetation with a notably different density and physiognomy (see fig. 19)]—Low: different vegetation association less than 0.5 km. away; Medium: different vegetation between 0.5 and 1.0 km. away; High: different vegetation more than 1.0 km. away.

These characterics of the vegetation will be derived from analyses of photographs and slides of the biotopes and by notes and observation made in the field, but not, however regrettably, from measurements or comparative estimates made in the field.

A listing of plants collected by the expedition will be given for each biotope. In parentheses after each plant is a number or numbers corresponding to the major localities (fig. 24) wherein the plant was collected from the biotope in question. With few exceptions, only plants which occurred frequently or appeared to be ecologically dominant were collected.

The biotopes of Afghanistan will be discussed under two major headings and five subheadings as follows:

I. *Dry Habitat:* having less than 400 mm. of precipitation per year. Humlum (1959, p. 17) includes 97.5 per cent of Afghanistan in this category, as only Monsoonal Afghanistan has more than 400 mm. of precipitation per year. The major subdivisions of dry habitat are: A, Mountains and Associated Terrain; B, Steppes and Semi-Deserts, and C, Anthropogenic Habitat.

II. *Wet Habitat:* having more than 400 mm. of precipitation per year. Humlum's Monsoonal Afghanistan, but excluding the Jalalabad Vale. There are two major subdivisions: A, Mountains and Associated Terrain, and B, Anthropogenic Habitat.

BIOTOPES OF DRY HABITAT

A. Mountains and Associated Terrain

1. *Alpine Habitat above 3000 m.*—Alpine habitat could be subdivided into three biotopes: 1) high areas having permanent ice and snow; 2) high montane meadows, and 3) rocky slopes and talus slides; however, since the expedition made no collections above 3000 m. this terrain will simply be referred to as alpine habitat.

Characteristic elements of this environment are enumerated by Taber and Hoffman (1963). These elements include avalanches, land slips, wind throw, rapid erosion, and meterological extremes, such as strong insolation and wind, plus great diurnal temperature extremes and great extremes between sun and shade. Further, this environment often affords a close juxtaposition of strong biotic contrasts due to changes in altitude, slope aspect, shading, and differences due to air drainage, soil and snow accumulation.

In Afghanistan the distribution and character of the vegetation seem to correspond to the occurrence of these extremes. Proceeding from low to high altitudes and from wet to dry areas, the changing vegetation becomes sparse and stunted as the physiognomy of the surviving vegetation is modified to withstand these environmental extremes. Trees and shrubs are depressed. Several genera of shrubs form dense hemispherical crowns with exterior surfaces like clipped hedges and are collectively called tragacanth vegetation. At high elevations where tree and shrub vegetation is absent, bunch grass, small sedges, and procumbent forbs can be found. Ephemeral plants are adapted to flower and produce seed quickly and then disappear as the surface soil on well-drained slopes and plateaus is rapidly dried by the desiccating action of strong seasonal insolation and wind. Little vegetation is found above 4000 m. Well-drained slopes, some with talus, and dry plateaus are barren. Areas combining adequate subsurface soil moisture and some protection from the wind, such as ravines or the base of a rock, form islands of vegetation in these cold deserts.

I climbed above 3000 m. at three places in Afghanistan and made the following observations: In the Wakhan Corridor the north-facing

FIG. 3. Looking southeast from the summit of Shibar Pass. The slope and plateau biotope of montane habitat below 3,000 m. A—dry land farming; B—bunchgrass and *Artemisia* steppe.

slopes flanking the headwaters of the Oxus river had scant vegetation. Talus slopes and cliffs contrasted with shrubby ravines and alluvial fans, having low shrubs and bunch grasses. Vegetation was thicker close to the bases of rocky outcrops or boulders than in open areas farther away. In the Paghman Range west of Kabul fewer talus slopes were in evidence and the relief was not as great as in the Wakhan. However, the contrast between vegetation of severely drained and less severely drained land features was similar. In minutes one could walk from a moist high mountain gully with vegetation having a high density, low shade, two strata, irregular distribution, and low homogeneity to a horizontally-adjacent, dry, rubbly slope with vegetation having a low density, low shade, one stratum, clumped distribution, and low homogeneity. These observations were made on a northeast-facing slope of 30 to 40 degrees. A rubbly slope on the opposite side of the valley appeared to be almost barren of vegetation. Presumably because these mountains get some precipitation from the monsoons, the slopes have more vegetation than was seen in the Wakhan, but less than eastern mountains receiving more monsoonal rain.

FIG. 4. The north side of Sauzak Pass. The obvious ecological dominants are juniper trees and tragacanth vegetation (A).


A

2. *Slopes and Plateaus below 3000 m.*—This biotope has a clay loess substrate with a covering of coarse gravel and small stones.

FIG. 5. Scree-covered slopes of the Wakhan Corridor at 2,750 m. The horizontal boundary in the center of the picture denotes an irrigation ditch above which scant vegetation is found. The valley floor has low (grazed) lawn-like grass and sedge. Trees, some reaching 5 m., surround a stone grain mill (A).

Mountains in southern Afghanistan are almost devoid of vegetation. Slopes of mountains in Nuristan, Badakhshan, North and Northwest Afghanistan frequently support an open stand of trees, often junipers and pistachio. North-facing slopes generally have more vegetation than south-facing ones. Thus vegetation reflects the climatic extremes and varying topography of this biotope. Figures 3 and 4 illustrate the widely different types of vegetation that are found in this biotope.

The vegetation in Figure 3 (A and B) has high density, irregular distribution, low shade, one stratum, and low homogeneity; in Figure 4, low to high density (some slopes of clay being devoid of vegetation), irregular distribution (clumped for tragacanth vegetation), low to high shade, two strata, and low homogeneity are noted.

FIG. 6. The east-facing slope of a low mountain (823 m.) bordering the Kunar River about 35 km. north of Jalalabad. The cave is approximately 25 m. deep.

FIG. 7. A low (1,130 m.) mountain between Kandahar and Babi Wali. The truck, top center, is dwarfed by the huge boulders on this slope.

The expedition collected the following plants from this biotope: *Artemisia* sp. (2), *Lepidium latifolium* (2), *Chrozophora oblongifolia* (4, 7), *Mentha* sp. (2), *Allium* sp. (2), *Calotropis procera* (11), *Mertensia* (2), *Trichodesma* (4), *Anchusa* sp. (2), *Arenaria* sp. (2), *Suaeda* sp. (2), *Ceratocarpis* sp. (2), *Arthrophytum* sp. (2), *Reseda* sp. (4), *Rosa* sp. (4, 8), *Hyoscyamus* sp. (2), *Zygophyllum fabago* (2), and many species of Graminae (2, 3, 4).

3. *Rock-covered Slopes and Plateaus.*—This is a biotope of stones and boulders, usually mixed with and covering clay and loess soil. Talus slopes, cliffs, and alluvial fans are part of this biotope, the latter being included because of their heterogeneous nature; however, alluvial fans could well be considered as the meeting place of montane biotopes with each other, or with steppe and semi-desert biotopes.

The rock biotope is common in mountainous Afghanistan. The amount of vegetation found in this biotope depends on the origin of the rock, the surface area it covers, and the relief and aspect of the slope. Hillel and Tadmor (1962), in a study of the water regime and vegetation in the Central Negev highlands of Israel, observe: "The stone mulch of rocky slopes apparently retards runoff, prevents the formation of a continuous crust, and slows the rate of evaporation. Subsurface stones decrease the capacity of the soil thereby causing

an increase in the depth of moisture penetration. Rocky slopes thus form an appreciably moister habitat than plains of loess, where the continuously crusted surface absorbs less water and loses more in drying."

Figure 5 illustrates the barren, scree-covered slopes of the Wakhan Corridor. Figure 6 shows a shallow cave on the east-facing slope of a mountain bordering the Jalalabad Vale. The dried brown vegetation blends with the rocks. The characteristics of the vegetation on this slope are: low density, clumped distribution, low shade, one stratum, and low to medium homogeneity. Figure 7, taken on a low mountain north of Kandahar, has vegetation similar to that of Figure 6, but beyond the truck the scree-covered valley floor is barren except for a few low, widely-scattered grasses. Figure 8, unlike the foregoing three figures illustrating products of mountain degradation, shows protruding bedrock. The vegetation of this area has medium density, a clumped distribution, low shade, one stratum, and high homogeneity. It can be seen that rocky areas on open slopes represent a rather barren biotope contrasting with similar terrain having a supply of water (fig. 11).

The following plants were collected from this biotope: *Aerva* sp. (11), *Calotropis procera* (11), *Mertensia* sp. (2), *Echium* sp. (4), *Tri-*

FIG. 8. Protruding bedrock on undulating hills (2,286 m.) 27 km. northwest of Ghazni.

FIG. 10. The Kunar River floodplain showing a dense growth of riparian vegetation (species of *Typha*, *Scirpus*, and *Cyperus*), contrasting with zerophytic semi-desert vegetation (A) a mere 2 m. higher. Top right is a low, rock-covered mountain with scant vegetation.

chodesma sp. (4), *Cleome quinquenervis* (11), *Anthochlamys* sp. (12), *Salsola* sp. (13, 14), *Artemisia* sp. (2, 3), *Lepedium latifolium* (2), *Brassica* sp. (3), *Mentha* (2), *Zizophora clinopodioides* (3), *Allium* sp. (2), *Rosa* sp. (4, 8), *Verbascum sinuatum* (4), *Peganum harmala* (7), *Dianthus* sp. (1), and Graminae spp. (2, 4, 11, 12).

4. *Montane Watercourses.*—This biotope can be thought of as being superimposed upon other (subordinate) biotopes. Occasionally, it is desirable to specify this subordinate biotope. In this event the watercourse and subordinate biotope will be separated by a slash: e.g., 'montane watercourse/rock biotope,' indicates a mountain stream flowing through the rock biotope. The relatively dense vegetation of this biotope contrasts with adjacent biotopes having drier substrate and sparse vegetation. Figures 9, 10, and 11 illustrate this. The vegetation of the seepage in Figure 9 has a high density, even distribution, medium shade, three strata, and low homoegeneity, while the surrounding *Artemisia* steppes have a high density, irreg-

FIG. 9. A seepage on the east side of Shibar Pass. The thick vegetation of this wet site contrasts with the surrounding *Artemisia* steppes on drier slopes.

ular distribution, low shade, one stratum, and medium homogeneity when the entire pass is considered. The character of the vegetation in Figures 10 and 11 differs little from that of Figure 9; the most obvious difference being the density, which is low for the dry, rock-covered mountains.

Plants collected from this biotope include: *Berberis aristata* (8), *Lycopsis* sp. (2), *Anchusa strigosa* (4), *Campanula* (2), *Saponaria vaccaria* (3), *Dianthus* sp. (1, 2), *Chenopodium* sp. (2, 3), *Cardaria draba* (2), *Erysium* sp. (2), *Lepidium latifolium* (2), *Hippophal rhamnoides* (3), *Hemerocallis* (1), *Populus* sp. (2), *Rumex crispus* (1), *Polygonum nepalense* (1), *Potentilla aff. sericea* (3), *Tamarix* sp. (4), *Peganum harmala* (2, 7), and species of Cyperaceae (1), and Graminae (2, 3 4, 11).

B. Steppes and Semi-Deserts

1. *Clay and Loess,* sometimes mixed with small stones.—This biotope is prevalent in North, Northwest, West, and South Afghanistan, being found to a lesser extent in East Afghanistan and the Jalalabad Vale.

Clay-loess mixed with or covered by small stones is frequently referred to as a stony or pebble desert. These deserts can be thought of as terrain associated with mountains, however, disregarding the forces necessary for their formation, I consider a stony desert to be any plateau covered with stones or pebbles having a diameter of less than 100 mm. There is no sharp separation between stony deserts and the broad, overlapping, alluvial fans of mountains. The stony deserts are merely a transitional zone between montane and steppe and semi-desert habitat.

Huntington (1905, p. 251) citing McMahon states: "the Dasht-i-Margo extends eastward 150 miles without change or interruption from the top of the bluffs immediately west of the Sistan Basin (in Iran) to the first mountain, Malik-Dokhand, in Baluchistan.[1] In this distance the plain rises 2,500 feet (762 m.)—less than 17 feet per mile —and yet gravel has been smoothly distributed everywhere." Large tracts of stony desert were traversed by the Street expedition in Collecting Localities 13, 14, and 15.

Figure 12 illustrates vegetation on a south-facing slope of a loess hillside 20 km. west of Kunduz. The characteristics of vegetation in this area are: high density, low shade, one stratum, clumped distribu-

[1] Malik–Dokhand mountain with a peak of 2200 m. is found in South Afghanistan near the Afghan–Baluchistan border.

FIG. 11. The water of a small stream draining the rock-covered mountains of the Kabul River valley is sufficient to support tree and scrub vegetation. Adjacent slopes and cliffs show a scattering of herbs and grass.

FIG. 12. Hill of loess west of Kunduz with typical steppe vegetation. Dr. Lewis is placing traps between clumps of *Artemisia*. Individual plants of *Zygophyllum* sp. can be seen in the foreground.

FIG. 13. Clay and loess semi-desert near Kandahar. Beyond camels are low ridges of sand. Low mountains in the background have a predominately rocky substrate.

tion, and high homogeneity. Figure 13 illustrates a semi-desert near Kandahar with vegetation having: low density, low shade, one stratum, clumped distribution, and medium homogeneity (when the sparse vegetation in the foreground is compared with the thicker vegetation growing on low ridges of sand).

Plants collected in this biotope include: *Tamarix* (6, 13, 15), *Reseda* sp. (7), *Diarthron* sp. (7), *Artemisia* sp. (7, 11, 12, 13), *Convolvulus* sp. (6), *Citrullus colocynthis* (11, 12), *Chrozophora oblongifolia* (5, 6, 7, 11), *Heliotropium eichwaldii* (5, 11, 13), and the chenopods *Suada* sp. (5, 6), *Artiplex* sp. (0, 0), *Traganum* sp. (5), *Haloxylon* sp. (15), and *Halocharis* spp. (6). Scattered between the foregoing scrub *Tamarix* sp. and herbs were many species of Graminae often forming an open bunchgrass steppe.

2. *Sand Substrate.*—The major locations of the sand biotope are illustrated in Figure 2. Sand often covers different substrates. I observed large sand dunes supporting little vegetation juxtaposed with small dunes and mixtures of sand, clay, and/or loess which supported substantial amounts of vegetation. Figure 14 is typical of this biotope in Afghanistan. The vegetation has: medium density, low shade, one stratum, a clumped distribution, and high homogene-

FIG. 14. Sand biotope found east of Shibarghan. Bunchgrasses are typical of the North Afghanistan steppes, as are many species of thorny shrubs.

ity. Plants collected from this biotope include: *Haloxylon* sp. (12, 15), *Halarchon vesiculosus* (12), *Artemisia* sp. (12), and *Citrullus colocynthis* (12). Many sod-forming bunchgrasses, species of Graminae, were taken. These are prevalent in Figure 14.

3. *Watercourses.*—Ephemeral and Perennial. Watercourses are an important biotope in the steppes and semi-deserts. By providing water and a place for seeds to germinate, this biotope enables a relatively large amount of vegetation to exist where otherwise only a few scattered plants could grow. This author scanned over 50 aerial photographs taken in South and East Afghanistan. River banks and wadis (=ephemeral watercourses) were clearly seen as ribbons of vegetation winding through barren plains with little or no vegetation. Shallow depressions had more vegetation than adjacent but higher terrain, salt playas excepted. At least ten aerial photographs from South and Southeast Afghanistan contained one or more salt playas showing as greyish-white and appearing devoid of vegetation. The most distinguishing characteristics of vegetation in this biotope are high density and low homogeneity.

The following species were collected from this biotope: *Heliotropium eichwaldii* (13), *Chenopodium* spp. (12), *Salsola* sp. (14), *Ha-*

loxylon sp. (15), *Halocharis* spp. (15), *Tamarix* sp. (13, 15), *Vitex pseudo-negundo* (13), and *Conyza* (13).

C. Anthropogenic Habitat

This habitat requires a special introduction, for many of the habitats of mammals in Afghanistan are altered if not produced by effects of intermittent or continual human interference. Through establishing oases, regulating the grazing of domestic livestock, gathering vegetation for fuel and fodder, and cultivating unirrigated soil, man has modified the natural environment and created a series of biotopes upon which certain species of plants and animals depend. Conversely, of course, some species have been eliminated from certain areas because of man's presence. Where there is a man-made structure (whether involved in irrigation or a building) a discrete biotope is created, which can be separated from the aforementioned natural biotopes. This structure biotope will be discussed after describing how the natural environment can be modified by man.

Oases are considered to be irrigated islands of mesophytic vegetation. Rice, wheat, cotton, melons, grapes, and pomegranates are a few of the crops commonly cultivated in oases. In the more arid parts of Afghanistan large trees are confined to oases or river banks. Figure 15 shows how abrupt the change from an irrigated area with trees to a relatively waterless and barren plain can be. Within oases there is crop and shade vegetation which is constantly irrigated and usually also weed growth on temporarily unirrigated, fallow terraces. Some unirrigated terraces are relatively barren between crops, due, in part, to the rather intensive grazing characteristic of oases and their vicinities. Pockets of dense vegetation can be found in areas which are not grazed or cultivated, such as tree farms, e.g., *Populus nigra* for lumber, or hillside patches of vegetation that receive seepage water from irrigation ditches delivering water to distant terraces.

The presence of oases not only modifies the density and arrangement of vegetation, but also provides a suitable environment for mesophytic plants. For example, I noted that the Ghorband River valley contains a chain of small, river-bottom oases between Charikar and the Shibar Pass. Kitamura (1960, p. 10) describes the following species of trees, shrubs, and mesophytic herbs from this valley: *Crataegus songarica, Spiraea Brauhia, Lonicera arborea, Celtis caucasica, Ficus palmata, Rosa begginiana, Campanula stricta, Erythraea centaurium, Datisca cannabina, Adenocaryum anchusoides,* and even a fern, *Adianthum capillusveneris.* He collected these species from a

FIG. 15. A peninsula of the Kandahar Oasis jutting into a xeric, stone-covered valley with scant, ephemeral vegetation.

small area with a constant water supply, concluding from his observations: ". . . the place acts as a stepping stone of the distribution of mesophytic plants through the corridor of the mountain chains." The most obvious and certainly the most prevalent areas with a constant water supply are the oases noted here.

Beyond oases much of the vegetation in Afghanistan is probably the result of continuous human interference. According to Curtis (1956): "The micro-environmental changes associated with the destruction of a climax formation of plants are usually in the direction of more xeric, lighter and variable conditions, which encourages the expansion of less conservative plants with such pioneer tendencies as the ability to withstand greater fluctuations in temperature and available moisture, the capacity for resisting disturbance through production of proliferating shoots or adventitious buds, and the possession of efficient means of rapid population increase." Many of the species collected by the expedition had one or more attributes of a plant with pioneer tendencies. Wormwood, *Artemisia* spp. (collected in eight localities and seen in six more), which are dominant and widespread in Afghanistan, belong to the same genus as the sagebrush, a common dominant of the North American semi-desert and often implicated as an invader of overgrazed ranges. Eyre (1963, p. 132)

goes a step further, making the following observations: "From the various descriptions available several general points can be made when one compares the Eurasiatic semi-deserts with the semi-deserts of North America. Firstly, herbaceous plants are of a much greater frequency than in the semi-deserts of North America; grasses in particular are much more important. Secondly, the Eurasiatic semi-desert is generally much more open, isolated bushes or tussocks of grasses existing, often in a half-submerged condition, in a sea of sand or loess. So great is the contrast between this sparse vegetation and that in areas of similar precipitation in North America [parts of Afghanistan are climatically similar to southern Arizona or Southeastern California][1] that one cannot help suspecting that successive millennia of exploitation by nomadic pastoralists have left a profound mark on the vegetation cover."

The nomadic and semi-nomadic habit of many Afghan people subjects large areas of the steppes and deserts to grazing of varying intensity. Flocks of domestic sheep and goats were seen grazing on hillsides almost uniformly etched by their inter-connecting trails (fig. 16). Vegetation was absent or confined to strips between the trails. Probably traditional migratory routes (drive trails) of the nomads receive the most intensive grazing. Michel (1959, p. 340), presented information obtained from a local official in Maimana, on how intensive this grazing can be. During a dry winter or a year of especially low rainfall local shepherds had to drive their flocks long distances to reach the Amu Darya, because the usual waterholes dried up, and early denudation of pasturage along the drive routes resulted in decimation of some flocks.

Figure 3(A) and Figure 17 illustrate non-irrigated agriculture (=dry land farming). Schurmann (1962, pp. 256–279) discussing the agricultural practices of the Moghols, some of whom inhabit the headwater valleys of the Farah Rud in Central Afghanistan, points out: ". . . non-irrigated agriculture, mainly wheat and barley, depends on adequate spring rainfall; if it is insufficient, the crop will be small. Fields are cultivated for one or two years then abandoned." The field in Figure 17 is fallow. In this condition it will absorb more

[1] Comments in brackets are my own, based upon: a report by the United States Army, Quartermaster Research and Development Center Environmental Protection Division, Analogs of Yuma Climate in South Central Asia (Natick, Massachusetts; June 1955).

FIG. 16. A loess hillside south of Kunduz. Horizontal, interconnecting livestock trails etch the entire hillside.

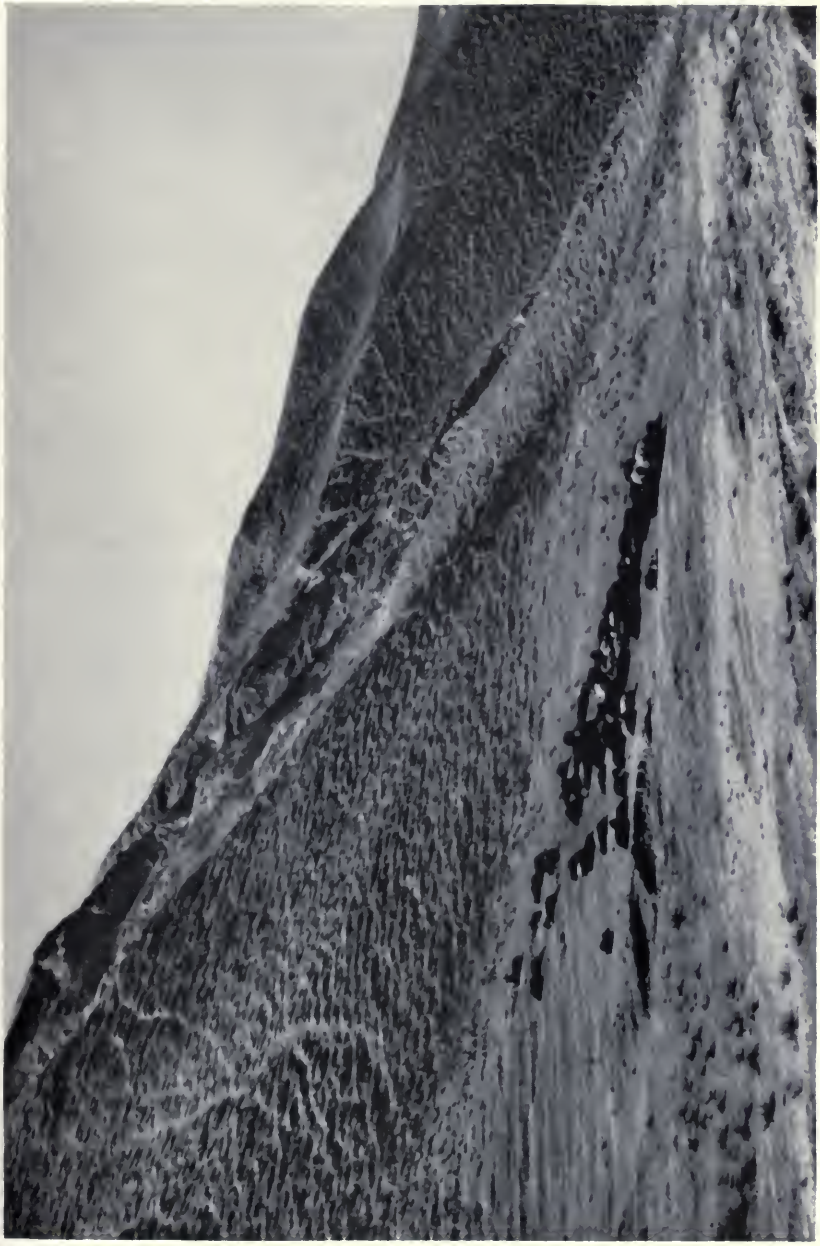


FIG. 17. A fallow field 3 km. east of Spin Baldak. Sand dunes can be seen beyond the fallow field.

water than adjacent untilled land. However, it is subject to wind erosion.

Lastly, the natural vegetation is harvested for fuel and fodder. Figure 18 shows a string of donkeys laden with fuel, *Artemisia* spp. Camels, donkeys and even Afghanistan people were frequently seen carrying huge loads of shrubby fuel. Forbs, e.g., *Prangos pabularia*, are gathered for fodder.

It may seem paradoxical, but in arid Afghanistan, where almost every scrap of vegetation is valued as lumber, shade, food or fuel, man's impact on the standing crop of vegetation is more severe than in humid regions having more moisture available for plant growth and regeneration.

1. *Structures.*—This biotope can be subdivided into three classes: One is composed of buildings and walls; a second of ditches, terraces, and underground aqueducts; and a third of roads and bridges. These structures may either be used or unused. Used structures may receive perennial or seasonal use, while unused structures, such as the

FIG. 18. Fuel, mainly *Artemisia* spp., gathered from the steppes near Shibar Pass.

FIG. 19. The Maimana Oasis and vicinity. A—irrigated, walled-in tree plantations and orchards with vegetation having a high density, irregular distribution, high shade, three strata, and low homogeneity; B—old, crumbling buildings protect shrubby vegetation from grazing; C—a livestock trail and an unprotected, unirrigated field having little vegetation.

FIG. 20. Step-like terraces above the east bank of the Kunar River. The supporting wall of each terrace is composed of many rocks. Wheat is the main crop.

buildings illustrated in Figure 19, are usually in various stages of decay.

Buildings and walls are mainly of dried clay and loess, such as the ones shown in Figure 19. Stone is seldom used in the construction of houses; however, in mountainous Afghanistan many fences and the supporting sides of terraces (see fig. 20) consist of stones and rocks few of which are larger than could be carried by a single man. Structures of wood are in the minority, being found locally in Monsoonal Afghanistan.

As one would expect, irrigation works have the greatest effect on the distribution and density of vegetation. Figures 5, 15, and 19 illustrate this.

The following plants were collected from within oases or along irrigation ditches: *Lycopsis* sp. (2), *Cynoglossum off. lanceolatum* (2), *Campanula* sp. (2), *Dianthus* sp. (1, 2), *Gypsophila* sp. (3), *Chenopodium* sp. (2, 3), *Cichorium* sp. (1), *Artemisia* spp. (3), *Cuscuta* sp. (2), *Convolvulus arvensis* (3, 5), *Sisymbrium* (1), *Cavdaria draba* (2), *Erysium* sp. (2), *Lepidum latifolium* (2), *Brassica* sp. (3), *Hippophae rhamnoides* (3), *Euphorbis* sp. (3), *Geranium* (3), *Prunella vulgaris* (2), *Mentha* sp. (5), *Hemerocallis* sp. (1), *Malva neglecta* (1), *Epilobium hirsutum* (5), *Polygonum nepalense* (1), *Polygonum* sp. (5), *Rumex* sp. (3), *Potentilla aff. sericea* (3), *Tamarix* sp. (13), *Verbena officinalis* (5), *Peganum harmala* (3). Species of *Cyperaceae* (1, 12) and Graminae (2, 3, 5, 11, 12, 13, 15) were also collected.

BIOTOPES OF WET HABITAT

Steep mountains predominate in Monsoonal Afghanistan. I saw no steppes or semi-deserts and very little level terrain. Only small areas were free of stones, rocks or scree. All aspects of the slopes had some trees. The characteristics of vegetation found along ephemeral watercourses did not appear to be appreciably different from vegetation found away from these watercourses, however, along perennial streams there were more mesophytic species and the undergrowth was thicker. The foregoing factors considered, and with the exceptions of alpine habitat, the biotopes of Dry Afghanistan do not apply to monsoonal habitat.

Alpine habitat *per se* will not be discussed, for no collections were made above 3000 m.

A. Mountains and Associated Terrain

1. *Conifers.*—1800–3000 m. (and higher to 3500 m.). In the vicinity of Kamdesh this biotope was found above 2700 m. I made three excursions into this biotope. There was a clay substrate covered with coarse gravel, small stones or rocks and, in local areas, organic detritus. The diameter at breast height (d.b.h.) of the conifers illustrated in Figure 21 was not over half a meter, while cedars observed on a different slope were much larger, many exeeding one meter d.b.h. There was a scattering of shrubs in the understory. In open areas a greater density of shrubs was found than in the shaded understory of the coniferous forest. The undergrowth of a coniferous forest above Kamdesh showed evidence of being grazed, and the reducing effect of this on the herbaceous understory was more noticeable as one approached the village.

The vegetation in Figure 21 had a medium-to-high density, even distribution, high shade, three strata, and low-to-medium homogeneity. Plants were not collected in this biotope.

2. *Evergreen Oaks.*—This biotope is characterized by slopes with a substrate of clay, rocks, rock slides, and cliffs supporting a woodland of predominantly evergreen oak, *Quercus baloot*, with an average height ranging from 4–5 m. It was the prevailing biotope in the

FIG. 21. Conifers above the village of Kamdesh.

areas of Monsoonal Afghanistan that were visited by the expedition. Oaks covered the slopes from the Bashgul River (1300 m.) to the coniferous zone (2000 m.). I saw few trees higher than 7 m., nor did any have a d.b.h. greater than a third of a meter. The understory varied, more shrubs and herbs being found on the north-facing slopes. Scree-covered slopes supported a scattering of scrubby oaks and little else. At 1500 m. on a northeast-facing slope of 40 degrees a small, abandoned corral having a dense covering of grass with scattered herbs was surrounded by a thick oak forest with a shrubby understory.

Figure 22(A) illustrates an evergreen oak forest having vegetation with: medium density, medium shade, three strata, even and irregular distribution, and medium-to-high homogeneity. Figure 22(B) illustrates vegetation on a typical, scree-covered slope having a low-

to-medium density, low shade, three strata, irregular distribution, and low-to-medium homogeneity.

FIG. 22. The Bashgul River valley. Slope A illustrates an evergreen oak forest; B shows a steep mountain covered with scree and a more open stand of oaks.

The expedition collected the following plants in this biotope, all from locality number 10 (Kamdesh): *Polygonum* sp., *Bidens* sp., *Cichorium* sp., *Quercus baloot, Solanum nigrum, Physalis* sp., *Lespedeza* sp., and species of Graminae.

3. *Perennial Watercourses.*—The densest naturally-occurring vegetation found in Afghanistan occurs in this biotope. The undergrowth is often thick. Rocks and trees may be partially covered with moss. Ferns and vines are common. Organic mulch is frequently 100 mm. deep. Wet meadows have a dense covering of herbaceous vegetation.

The author observed this biotope to support vegetation having a high density, high shade, three strata, irregular distribution, and low homogeneity.

The following plants were collected in this biotope: *Impatiens edgeworthii, Cynoglossum off. lanceolatum, Chenopodium* spp., *Epilobium hirsutum, Clematis graveolens, Ranunculus constantinopolitanus, Physalis alkakingi, Conya* sp., *Artemisia* sp., *Euphorbia, Malva*

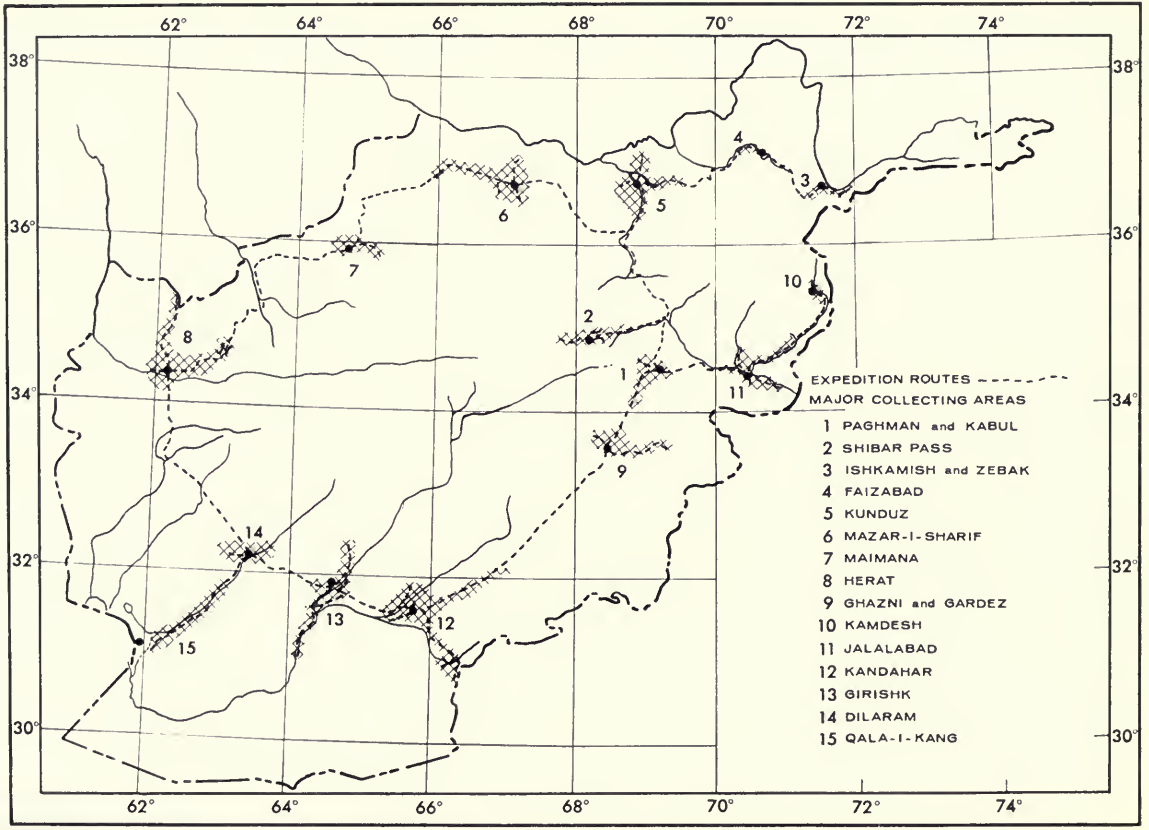
neglecta, Cannabis sativa, Mentha sp., *Solanum nigrum,* and species of Graminae.

B. Anthropogenic Habitat

1. *Structures* (described on p. 49).—There are no oases in Monsoonal Afghanistan. There is no sudden transition from water and vegetation to no water and no vegetation. Irrigation is practiced, but structures for this purpose are insignificant when compared with their counterparts in Dry Afghanistan. Crops are sown wherever it is convenient to cultivate. Figure 23 illustrates this. Houses are built only where there is a perennial supply of water. They are constructed of wood, clay, and stone.

Houses are the most significant part of this biotope, unlike the structure biotope of arid Afghanistan where structures related to irrigation had this distinction. No plants were collected from anthropogenic habitat, but with the exception of cultivated crops the composition of the vegetation in the vicinity of structures probably differs little from that found in more natural areas. I noticed persimmon, walnut, and pomegranate trees along the Bashgul River.

Fig. 23. Stream bottom with anthropogenic habitat. Corn was grown on a series of step-like terraces. The scree-covered slope almost obscured in the background is similar to the one shown in Figure 22.


62°
64°
66°
68°
70°
72°
74°
38°
36°
34°
32°
30°
EXPEDITION ROUTES
MAJOR COLLECTING AREAS
1 PAGHMAN and KABUL
2 SHIBAR PASS
3 ISHKAMISH and ZEBAK
4 FAIZABAD
5 KUNDUZ
6 MAZAR-I-SHARIF
7 MAIMANA
8 HERAT
9 GHAZNI and GARDEZ
10 KAMDESH
11 JALALABAD
12 KANDAHAR
13 GIRISHK
14 DILARAM
15 QALA-I-KANG

COLLECTING LOCALITIES AND ITINERARY

The present section contains descriptions of the 15 major collecting localities that are illustrated in Figure 24.

The exact location and spelling of Afghan place names is often difficult because of differing ways of transliterating names from Arabic to English letters, as well as the application of various names to one locality on different maps and in the literature. Therefore, to assure the readers what places our specimens came from, a gazetteer is appended to this section, sometimes with several spellings of place names and usually with latitude and longitude in degrees and minutes. It is limited to place names that are cited in the text of this paper. Where possible, the spelling employed by the *Times Atlas of the World, Mid-Century Edition*, John Bartholomew (1959), is used.

Each of the following 15 descriptions is prefixed by: the name of the major collecting locality and its numeral illustrated in Figure 24; the co-ordinates and altitudes of overnight camps (i.e., collecting localities are named after the largest city or village contained therein, co-ordinates of the locality, except in the gazetteer, refer to the site of our camp and only to these cities if our campsites were in them); the dates spent in each locality; and a list of the biotopes from which we collected mammals.

During the course of the expedition our party was often divided, one group working in the vicinity of our base camp while a second party was collecting in a different major locality. In these instances the same dates will, of course, be shown prefixing different localities, but with such dates followed by the initials of the collectors involved: Atallah (A), Hassinger (H), Lewis (L), Neuhauser (N), and Street (S).

The following descriptions contain general ecological information about each locality with a listing of specific sites where traps were placed. The mean daily temperatures are derived from an average of 12 measurements, one every two hours commencing at midnight.

FIG. 24. Map of routes and collecting localities of the Street Expedition to Afghanistan. Localities are listed in order of visitation.

The numbers and species of terrestrial mammals trapped, otherwise captured, or purchased in each locality will be listed in Table 1 following this section. Purchase of specimens from furriers is indicated with a P. The number of species of bats taken at each collecting locality will be given; however, the specific names will not be listed.

Reference will be made to the collections of ectoparasites taken from 13 of the 15 major localities; however, the smaller samples of plants, herpetological materials, and mollusks, collected in most of the localities will not be mentioned.

1. **Paghman** and **Kabul**

34°36′N 68°56′E; 2440 m.; July 12–23; Aug. 1, 2, 5–9; Sept. 27–31; Oct. 1–6, 9–11, 26–28; Nov. 22–26. Prevalent biotopes: Slope and plateau, Structure, Watercourse, and Rock, in dry, montane habitat.

The capital city, Kabul, was the best place for reprovisioning and repairs, and we consequently planned our itinerary to include a number of returns to this city, which is the reason for the numerous dates recorded for this locality. Most of our collecting near Kabul was accomplished between July 12 and 23, while we were encamped in the Paghman oasis. On other returns to this vicinity we stayed in Kabul and collected less. All collections in locality 1 were made between 1900 and 2900 meters.

Collecting excursions beyond the vicinity of the main camp included:

1) Qala Safed Ouanai cave, southwest of Kabul.... July 21. N.
2) Lalander cave, near Kabul, also known as Dahnar-Ghar, Oct. 4. N., A.

Days were hot and dry, nights were cool, there was no rain. The mean temperature for nine days (July 13–18, 20–22) was 24.2°C with a mean max. and min. of 32.0°C and 18.3°C, respectively. Figure 25 is an example of the diurnal temperature fluctuation, which we experienced during most of our collecting days in Afghanistan. Highs and lows were recorded for different hours, but our entire set (50 days) of temperature records showed similar variation in each of the ten localities for which temperatures were recorded.

The lush vegetation and boulder-strewn terraces of the Paghman oasis cover a gently sloping, narrow valley tract that spreads toward Kabul. There were many orchards and other tree plantations within the confines of the narrow Paghman valley. The alluvial fans which

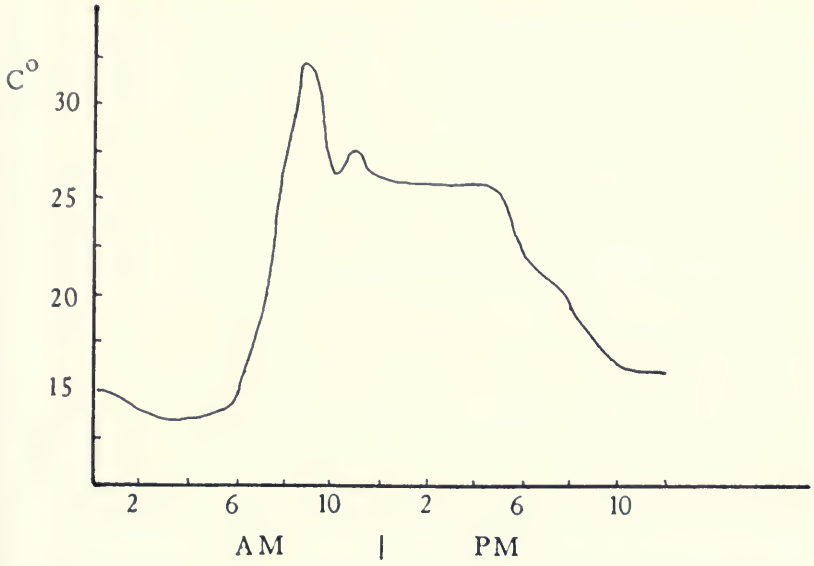


FIG. 25. Temperature variation on July 18 at Paghman, Afghanistan.

extend south and east from the Paghman escarpment contain fields and terraces of wheat, barley, and corn. Vineyards predominated along the Kabul-to-Charikar road.

In the Paghman, and to a somewhat lesser extent the Kabul, oases, we set our traps on earthen embankments of irrigated and fallow terraces; in old fields on unused, decimated terraces; along rock walls supporting hillside irrigation ditches or fencing fields and terraces; in the undergrowth and litter of tree farms and orchards; on rock-covered hillsides between a small stream (5–10 m. wide) and higher irrigation canals; in a vineyard; and about old buildings. Beyond the confines of the oases, dry and moist rocky outcrops, the talus of an east-southeast-facing mountain slope, and the base of an abandoned rock bridge were similarly sampled. Night hunting was mainly confined to the two roads (one completely paved, the other about half paved) traversing the 20 km. between Kabul and Paghman. Terrain adjacent to the paved road between Kabul and Ghazni was spotlighted. However, most of the night hunting in this sector was done near Kabul.

Thirty-one terrestrial mammals were shot or netted while hunting, 161 were trapped, and 35 were purchased from the local populace. We also bought five specimens from the fur bazaar in Kabul. The

furrier gives the following localities as the collecting sites of these purchases: *Vulpes corsac* (North Afghanistan), *Martes flavigula* (Central Afghanistan), *Lutra lutra* (Central Afghanistan), and *Felis uncia* (Wakhan). A patch of *Marmota caudata* fur found in the vicinity of the Anjuman Pass was given to us in Kabul.

Most of the above mammals were examined for ectoparasites. Burrow systems of *Microtus afghanus* and *Meriones libycus* were excavated and inspected for ectoparasites. Fleas were aspirated from the walls of these burrows and from loose soil and nest material scraped from the tunnels.

2. Shibar Pass

34°53′N 68°06′E; 2440 m.; July 23–Aug. 1; Oct. 2–3, N., H. Prevalent biotopes: Slope and plateau, Structure, Watercourse, and Rock, in dry, montane habitat.

Our main camp was located at a small village called Shombul, about 12 km. west of Shibar Pass. All of our collections in this locality were taken from between 2600 and 3300 m. elevation.

Excursions beyond the vicinity of the main camp included trips to:

1) Bamiyan, west of Shombul.....July 27, 28. H., L. and July 29, A., N., S.

2) Madan-Sorb cave, a lead mine near Farindjal, Oct. 2, 3. H., N.

There was no rain. Days were warm and nights were cold. The mean temperature for July 29 to 31 was 22.9°C with a mean max. of 38.7°C and a mean min. of 11.0°C.

This locality was characterized by steep, boulder-strewn valley sides, valley floors with terraces of wheat, and the rolling slopes spreading from the apex of Shibar Pass west toward the Bamiyan valley. The bunch grass steppe of the pass was limited to the perimeters of fallow fields and to the slopes, which were not planted with barley or wheat (see fig. 3).

Near the summit (2745 m.) of Shibar Pass we set our traps around the edges of fallow fields and in the bunch-grass steppe. We set our traps on the steeper east-facing slope of the pass in a small seepage and on the drier hillside surrounding this wet gulley (see fig. 9). Near our camp at Shombul traps were set in clumps of willows or in rocky crevices along a stream one to three meters wide, in a hillside tree (*Populus* sp.) plantation, around the foundations of grist mills and old earthen ruins, and in the stone piles and fences surrounding a culti-

vated wheatfield. Beyond these areas of human habitation, boulder-strewn hillsides, rocky outcrops, and some stream side talus between steep, sloping valley sides were trapped for mammals. Near Bamiyan we set out traps around the base of a dry, conglomerate cliff and in an adjacent erosion gulley. Vegetation was scant. Most of our night hunting was done in the valley between Shombul and the summit of Shibar Pass.

There were 120 mammals captured in traps, 13 shot, and a single specimen was purchased. While night hunting we saw a stone martin, *Martes foina*, but were unable to collect it.

We examined most of the mammal specimens and the burrow systems of *Microtus afghanus* and *Cricetulus migratorius* for ectoparasites.

3. **Ishkamish** and **Zebak**

36° 42′ N 71° 46′ E; 2623 m.; Aug. 12–16. 36° 32′ N 71° 21′ E; 2653 m.; Aug. 17, 18. Prevalent biotopes: Slope and plateau, Structure, Watercourse, and Rock, in dry, montane habitat.

Our main camp was located about 19 road km. east of Ishkamish. Our last two nights in this locality were spent at a second campsite 3–5 km. NW of Zebak. Collecting in this locality was done between 2600 and 2900 m.

Days were cool and nights cold. There were trace amounts of rain. Near the summits of surrounding mountains fresh snow could be seen. No temperature records were obtained. The prevailing character of the terrain was barrenness. Steep mountainsides were covered with talus (see fig. 5), while the alluvial debris of the narrow valley floors contained rocks and boulders of varying sizes. Scant, weedy vegetation predominated except where small terraced patches of legumes, wheat, and barley were found.

Near Zebak the valley is wider. The vegetation is confined to irrigated hillside terraces or the valley floor. Poplars are cultivated, copses of willows are found along a stream big enough to contain German brown trout. Sedge and grass meadows are closely grazed.

We set our traps around boulders which were often larger than our trucks, and in the talus at the base of the steep sides of the Wakhan corridor. Rock walls, stone grist mills, a wet, brushy mountain ravine, the base of a stone bridge, and a small grove with poplars and willows were examined for mammal signs and trapped.

Leaving the Wakhan and the headwaters of the Amu Darya, we traveled to Zebak along the headwaters of the Kokcha river. This village is about 32 km. southwest of Ishkamish, which is on the Amu Darya drainage. Here we set our traps on xeric, rocky valley sides, in stony or bushy fence rows, along the banks of a small stream bisecting an alfalfa field, about a grist mill, and in copses of willows and poplars.

This locality yielded 76 mammals. We shot *Lepus capensis* and *Vulpes vulpes* while night hunting. We purchased specimens of *Martes foina*, *Capra ibex*, and *Ovis ammon*.

The mammals were examined for ectoparasites.

4. **Faizabad**

37°08′N 70°25′E; 1006 m.; Aug. 18 to 20. Prevalent biotopes: Slope and plateau, Watercourse, Structure, and Rock in dry, montane habitat.

Our camp was located about 25 km. by road west of Faizabad along the Kokcha river. A small collection of mammals was made between 1000 and 1100 m.

The weather was milder than in the Wakhan. There were fewer clouds. Days were warm and nights cool.

The smoother and rounder foothills of this region are less spectacular than their Wakhan counterparts supporting fewer cliffs, less talus, and more grass and shrub vegetation. Numerous fallow fields indicated the prevalence of dry land farming. There were many erosion gullies and ravines. The valley floor was irrigated and cultivated wherever suitable. On many small riverside plains the black tents of nomadic Afghans were seen, their livestock grazing on adjacent hillsides or on small riverine pastures. Intermittently along the sandy river bottom clumps of marsh vegetation grew.

Near the river, which was about 50 m. wide at our camp, we placed our traps in the lush (ungrazed) understory of a small stand of trees, mainly poplar, willow, and mulberry. Away from the river we set our traps in erosion gullies and around the weedy edges of hillside, fallow fields.

Excluding a number of surplus house mice that were discarded, we trapped only seven specimens. Night hunting along the valley floor yielded one *Hystrix indica* and two *Vulpes vulpes*.

These specimens were examined for ectoparasites.

5. **Kunduz**

36°42′N 68°52′E; 549 m.; Aug. 20 to 30. Prevalent biotopes: Clay and loess, Watercourse, and Structure in dry, steppe habitat.

The entire party spent the night of August 20 at Taliq-an (36°46′N 69°29′E, 884 m.) before proceeding to Kunduz. A number of *Nesokia indica* trapped along an irrigation ditch and three species of bats purchased from a local boy constituted the collecting done around Taliq-an. Our major camp was established 8 km. south of Kunduz along a small road leading to the Kunduz airport. All collections in this locality were made between 500 and 800 m.

During our stay, days were hot and nights cool. It rained hard (1–2 cm.) for about 45 minutes during the morning of August 23rd. After this storm passed there was no more rain. The mean temperature record for the 23rd was 24.3°C with a max. of 29°C and a min. of 18°C. The temperature records for the 24th through the 29th are for the inside of a shaded tent. Testing with an ordinary thermometer, hand held, showed warmer in-tent temperatures than outside ones at any time of day, but inside approximated outside temperatures at night. The mean tent temperature for six days was 28.0°C with a mean max. of 40.5°C and mean min. of 18.1°C.

The wide, shallow Kunduz valley is heavily cultivated, but north and west of Kunduz, about 10 km., a slightly higher plateau of loess and sand has steppe vegetation and supports no crops (see fig. 12). Each day caravans of camels loaded with shrubs to be used for fuel were seen on these northern plains. South and west of Kunduz the low, rounded, loess foothills of the Hindu Kush showed signs of being intensively grazed (see fig. 16). The vegetation of wide valleys and alluvial fans between these hills is preponderantly xerophytic. There are no trees.

There was large scale cultivation of cotton in the oases; wheat and sugar beets are abundantly grown and there were some tree farms. One tree farm near our camp contained *Populus*, *Salix*, and *Alanthus*. There were also some orchards of apples, apricots, and mulberries.

Mammals were trapped along irrigation ditches, in the tall grass and alfalfa of an apple orchard, in the crevices of a stone fence surrounding an intensely irrigated, experimental farm, throughout a park having trees, shrubs, and grass but little organic mulch, and in a garden of low grass and mixed flowers within Kunduz. The non-irrigated terrain that was trapped consisted mainly of the flat or

rolling steppe and semi-desert north of Kunduz. Traps were also set in the loess hills west of Kunduz and in and around a cemetery near the airport. We did most of our night hunting on the plains north of Kunduz.

Ninety-three mammals were trapped. Hunting produced 49 terrestrial mammals, including our first *Spermophilopsis leptodactylus* and *Rhombomys opimus*, which were shot in the afternoon and at dusk, respectively. Night hunting yielded: *Hemiechinus auritus*, *Allactaga elater*, and *Vulpes vulpes*. Three animals were purchased. Ectoparasites were collected from most of the specimens. *Spermophilopsis* and *Nesokia* burrows were also examined for fleas.

6. Mazar-I-Sharif

36°43′N 67°05′E; 457 m.; Aug. 31 to Sept. 7. Prevalent biotopes: Clay and loess, Slope and plateau, Rock, Structure, and Watercourse, in dry, montane, and steppe habitat.

Our camp was situated on an Afghan government experimental farm along the western edge of Mazar-i-Sharif. All of our collections in this locality were taken from between 450 and 950 m. elevation.

There was no rain. The mean temperature for four days, Sept. 2 to 5, was 25.2°C with a mean max. of 32.5°C, a mean min. of 20.0°C.

North of Mazar-i-Sharif lies the central Asian steppes, and south, the foothills of the Hindukush. The rivers emerging from the Hindu Kush are consumed in irrigation, but not before they cut large erosion channels through the loess plains abutting the foothills. The hills are of loess and rock with a scattering of low trees on their north-facing slopes. The plains around Mazar-i-Sharif are sown with wheat and barley. Cotton is grown, and this is a major area of karakul sheep grazing in Afghanistan (Michel, 1959, p. 77).

We placed our traps along dry irrigation ditches bordering small fields, some fallow, other supporting alfalfa or grain. We also set traps among the trees, grass, and weeds bordering major water ditches, in dry ditches and gullies, along dirt roads and around the bases of earthen buildings and fences. In the foothills, dry rock slides, rocks bordering an irrigation ditch, gullies, a threshing platform, and a slope of mixed rock and loess were set with traps. Hunting was largely confined to steppe areas and marginal cropping situations, however; about three hours of one night were spent traversing a large alluvial fan with coarse gravel, relatively scant vegetation and a slight, east-facing slope.

Forty-three mammals were trapped, 23 shot or netted, and *Cricetulus migratorius* and *Felis manul* (from North Afghanistan) were purchased. We saw a jackal, *Canis aureus*, but were unable to collect it.

Ectoparasites were collected and the burrow system of a *Nesokia indica* was excavated and inspected for fleas.

7. **Maimana**

35°54′N 64°43′E; 884 m.; Sept. 7 to 15. Prevalent biotopes: Clay and loess, Slope and plateau, Rock, Watercourse, and Structure in dry, montane, and steppe habitat.

Our camp was in an experimental garden on the outskirts of Maimana. Collecting in this locality was confined to elevations between 800 and 1300 m.

Collecting excursions beyond the vicinity of our main camp included:

1) Belchiragh, E.S.E. of Maimana.....Sept. 12. A, H, L, N
2) Zarmast Cave, S.E. of Maimana.....Sept. 13. N

Maimana is within the foothills of the Paropamisus mountain range. These hills are mostly of loess and are cultivated, but seldom irrigated. Less than 20 km. east of the city the hills are less rounded and rock outcrops and some cliffs can be seen. The valleys in this region contain alluvial plains of redeposited loess, which in some of the narrower valleys east of Maimana contain an admixture of rock. The vegetation is typical of the open steppe and includes no trees except along the rivers and in oases. Grain crops predominate, and most of the hills showed signs of being intensely grazed.

Within the oasis of Maimana we placed our traps in moist alfalfa plots, on dry vegetationless pastures, along irrigation ditches, around the bases of earthen buildings (see fig. 19), and within the walled confines of a relatively lush tree farm. Beyond the city we set traps around the bases of old mud ruins, along mud and rock fences, around threshing platforms, in a dry gully, and in the talus of a northeast-facing slope of 40 degrees.

Trapping yielded 37 specimens, almost as many were purchased, while only five were shot. Night hunting was restricted, because of a gas shortage, to terrain along the road between Maimana and Belchiragh, and along the roads north and south of Maimana.

Specimens were examined for ectoparasites.

8. **Herat**

34°18′N 62°10′E; 915 m.; Sept. 16 to 26. Prevalent biotopes: Clay and loess, Slope and plateau, Rock, Watercourse, Structure and Sand in dry, montane, and steppe and semi-desert habitat.

We camped immediately south of Herat on the northern bank of the Hari Rud. Collections from this locality are from between 300 and 2450 m. elevation.

Collecting excursions beyond the vicinity of the main camp included:

1) Sauzak Pass, about 109 km. E.N.E. of Herat. .Sept. 16 and Sept. 21, 22. A, H.
2) Afghan Turkmeniyan border zone, south of Kushka Sept. 23. H, L.

The mean temperature at the Herat campsite for six days was 19.4°C with a mean max. of 31.1°C and mean min. of 9.3°C. There was no rain.

The large expanse of gardens and other greenery of Herat contrasts with the surroundings which consist mainly of low, rounded, barren-looking hills covered with rock detritus. Adjacent plains and basins generally have a covering of small pebbles but also open patches of unaltered loess. The predominating flora is typical as described above of semi-desert and steppe. Open stands of scrub tamarisk, clumps of poplars and willows, grassy meadows, and small reed beds occurred intermittently along the Hari Rud.

The Paropamisus mountain range is breached by the Sauzak Pass. North of the crests of this range, the road, winding down a gradual incline, is bounded on either side by tragacanth vegetation and scattered junipers sometimes in clumps (see fig. 4), while treeless slopes with open steppe vegetation and a scattering of cultivated grain fields stretch from the apex of the pass down over its southern slope to the floor of a narrow valley opening toward Herat.

North of the low Paropamisus range, near the Turkmeniyan border, the low, rounded, loess hills and plains were covered with patches of sand and steppe vegetation.

In the Herat oasis and along the Hari Rud we set our traps in the detritus and thick undergrowth of riverine vegetation and in the grass and brush of a relatively undisturbed tree farm. In addition, traps were placed on fallow barren terraces and between scattered, thorny shrubs lining the sides of an unused irrigation ditch. North of Herat a dry, boulder-covered, west-facing slope of 30° having

scattered clumps of grass with an admixture of camelthorns, an east-facing hill of loess, and a small loess plain etched with shallow, dry erosion gulleys were set with traps. We sampled both sides of Sauzak Pass setting our traps around the bases of traganthoid shrublets, in rock slides, under large boulders sometimes shaded by low, spreading junipers, in a clump of *Berberis* sp., and along the base of a stone wall supporting the one lane, dirt road above a small seepage area.

The hills and plains adjacent to roads north, south, east, and west of Herat were explored at night. Where feasible we left the highway and swept the surrounding plains with our spotlights. The Hari Rud river bottom, Herat oasis, and the entire 109 km. between Herat and the Sauzak Pass were also searched nocturnally for wild mammals.

Trapping produced 80 specimens, and our total catch for hunting (mostly at night) consisted of 45 animals. We purchased the following species from a bazaar furrier: *Canis lupus* (?), *Lutra lutra* (South Afghanistan), *Felis lynx* (Wakhan), *Felis manul* (?), and *Hyaena hyaena* (North Afghanistan). Natural areas, in parentheses, were given by the furrier as the original collecting localities.

While night hunting we saw three *Lepus* sp., two packs of more than four jackals (*Canis aureus*) each, and a *Hyaena hyaena*. We were able to collect a jackal but unable to obtain the hyaena or the hares.

Most of the material was examined for ectoparasites.

9. **Ghazni** and **Gardez**

33°36′N 68°33′E; 2104 m.; Oct. 6 to 9. Prevalent biotopes: Slope and plateau, Watercourse, Rock, and Structure in dry, montane habitat.

Our camp was located on the grounds of the new Ghazni prison about 9 km. southeast of Ghazni. Elevations between 2100 and 2450 m. were sampled.

Excursions beyond the vicinity of our main camp included a one-day trip to Gardez, Oct. 8, A, H, N.

The mean temperature derived from 12 records, one every two hours, for Oct. 8 was 14.6°C with a maximum of 21.0°C and a minimum of 10.0°C. Days were bright and cloudless.

Ghazni is situated near the convergence of two drainage systems, one draining north toward Kabul, the other south toward Kandahar. The wide NE–SW valley in which Ghazni is located appears barren. The surrounding hills and the mountainsides covered with boulders

and talus, and dissected by gullies, seem so barren as to be devoid of vegetation for areas as large as 50 sq. m. I noted larger barren areas on two separate hills. The semi-deserts and steppes south and east of Ghazni contain communities of thorny vegetation.

Gardez is situated approximately 80 km. east of Ghazni in a similar, wide valley. From Gardez a scattering of trees can be seen near the summits of mountains to the east. The foothills of these mountains are rounded, containing large amounts of talus fanning down from numerous rock outcrops. The Ghazni and Gardez oases are not large. The surrounding cultivated land, parts of which are irrigated and parts of which are dry farmed, are sown with grain, alfalfa, and melons. There is a stream running through Ghazni. Clumps of poplars and willows occur on its floodplain and farther south, bordering this same stream, an occasional clump of tamarisk stands out among the lower thorny shrubs.

We placed our traps around alfalfa fields, along irrigation ditches, among the supporting stones of a stream-side road, along the base of a mud fence, in the relatively dense thorny vegetation surrounding the prison and in the earthen banks of fallow terraces. In drier situations traps were placed among the earthen ruins of an abandoned building, in gullies, on talus slopes, and among the large boulders of the low hills northwest of Ghazni. Traps were also provided to bazaar owners in Ghazni to catch synanthropic mammals for us.

We trapped 58 animals, but our night hunting yielded but one specimen, an *Allactaga elater*. Within the village of Ghazni I found a number of *Rattus rattoides* which had been bludgeoned by the residents. We observed *Allactaga* sp. and *Vulpes vulpes*.

Mammals were inspected for ectoparasites, and samples of burrow systems housing *Meriones libycus* were excavated and searched for fleas.

10. **Kamdesh**

35°25′N 71°23′E; 1342 m.; Oct. 13 to 18. Prevalent biotopes: Conifer, Evergreen oak, Watercourse, and Structure in wet, montane habitat.

Kamdesh is situated on a mountainside about 500 m. above the Bash Gal River, a tributary of the Kunar. Our camp was about 8 km. east of Kamdesh near the village of Kamu. Collecting was confined to elevations between 1300 and 2150 m.

The mean temperature for 48 records, one every two hours for Oct. 13, 14, 15, and 16, was 18.0°C with a mean max. of 31.8°C and

a mean min. of 10.5°C. There were scattered showers on the 15th and 17th.

This locality is in that part of Afghanistan which receives precipitation sufficient to sustain forest from the left flank of the Indian monsoons. The terrain is mountainous with steep valleys and sheer cliffs (see fig. 22). The climate and vegetation is unique for Afghanistan; nowhere else, except on other eastern mountains under the influence of the monsoons, can Afghan mountainside vegetation of comparable density be found.

Near camp we set our traps along stone walls supporting the road following the course of the Bash Gal River, and in the crevices of rocks supporting terraces. Burrows in and around corn fields, and a north-facing slope with rocks and oak, were set with traps. Higher, around 2000 m., we placed traps among rocks along a mountain stream, in the talus below cliffs, in shrub and weed-covered erosion gullies, in a boulder slide, and in the understory of a clump of cedars. Steel traps were placed along the Bash Gal River and in a riverside stand of hawthorne trees. Rat traps were lent to the villagers of Kamdesh.

The most abundant species here, *Mus musculus*, was so dense that during one night we caught more than 100 in fewer traps. We caught 42 specimens besides *Mus*. Our local hunters brought us a *Capra falconeri*, but night hunting along the river bottom was unsuccessful because the nature of the terrain restricted our vision and vehicular maneuverability.

Most of the specimens, including numerous mice, which were subsequently discarded, were examined for ectoparasites.

11. Jalalabad

34°26′N 70°25′E; 732 m.; Aug. 2 to 5. A, H, L, N; Oct. 11, 12 and 19 to 26. Prevalent biotopes: Slope and plateau, Clay and loess, Rock, Watercourse, and Structure in dry, montane, and semi-desert habitat.

Our camp was located in a park near the center of Jalalabad. Collecting was confined to terrain between 600 and 900 m. above sea level.

Collecting excursions beyond the vicinity of our main camp included:

1) Nurgul, north of Jalalabad...Aug. 3. A, H, L, N; Oct. 19, 22. A, H, N.

2) Kalat-us-Siraj, northwest of Jalalabad...Aug. 4. A, H, L, N; Oct. 20. N. S.

3) Cave #61, near Nurgul.....Aug. 3. A, H, L, N; Oct. 19. A.

4) Qachqar Cave, near Nurgul..Oct. 19. A, H, N; Oct. 22. A, N.

5) Basawal, west of Kyber Pass.....Oct. 21, 24. A, H, L, N.

The mean temperature for 24 readings taken at two-hour intervals starting midnight Oct. 23 was 23.5°C with a max. of 29.0°C recorded at 3:00 P.M. on Oct. 24 and a min. of 18.0°C at 5:00 A.M. on Oct. 23. There was no rain.

Jalalabad is situated near the conjunction of the Kabul and Kunar rivers and in a wide valley encircled by high mountain ranges, 2700 to 4700 m. in elevation. The mountains extract rainfall from the high clouds of the monsoons and little falls on the Jalalabad and lower Kunar valleys, but mountain streams provide abundant water for irrigation. Thus, one observes a thriving agriculture along the rivers with citrus crops and from two to three cereal crops a year, while beyond this moist, irrigated soil the natural valley vegetation is typical of a semi-desert.

The mountain slopes are strewn with boulders between which a few shrubs and grasses grow at lower elevations. Higher, above 1500 m., there is a scattering of oaks and conifers. Contiguous alluvial fans spreading from the steep valleys and gulleys of these mountains are covered with rocks and coarse gravel, while farther toward the center of the Jalalabad Vale the semi-deserts have a fine soil.

Trapline sites included: irrigated gardens, a mountainside seepage on a north-facing slope of 60° having dense copse vegetation, in the Jalalabad bazaar, on the semi-deserts, in roadside gutters, in dry steam beds, under the boulders and rocks of dry talus slopes, and around the perimeter of an abandoned fort-like compound with earthen walls.

There were 33 specimens collected in traps, hunting yielded 11 more. Three *Suncus murinus* and three *Rattus rattus* were purchased from the local populace.

Most of the mammals were examined for ectoparasites, and a *Tatera indica* and a *Meriones libycus* burrow system were partially excavated in search for fleas and ticks.

12. Kandahar

31°39′N 65°40′E; 1006 m.; Sept. 26, 27, A, H, L, N; Oct. 28 to Nov. 10. Prevalent biotopes: Slope and plateau, Clay and loess,

Rock, Sand, Watercourse, and Structure in dry, montane, semi-desert habitat.

Our camp was located immediately north of Kandahar in the gardens of Baba Wali. Collections were taken from between 1000 and 1700 m. elevation.

Collecting excursions beyond the vicinity of our main camp were made to:

1) Shamshir Ghar (cave), southwest of Kandahar..Sept. 26. N; Oct. 29; Nov. 5 and 6. A, H.
2) Spin Baldak, SSE of Kandahar...Oct. 31. A, H, L, N; Nov. 7. A, H, L, N.
3) Kalat-i-Ghilzai, NE of Kandahar.....Nov. 5. N, S.
4) Bolan Cave, near Kalat-i-Ghilzai.....Nov. 5. N, S.
5) Caves, NW of Kandahar, close to 31°43′N and 65°30′E, Nov. 2. S.

Temperature records were kept for eight days, Oct. 30 to Nov. 6. The mean temperature for 96 measurements, one every two hours, was 13.7°C with a mean daily max. of 25.1°C and a mean daily min. of 7.2°C. There was no rainfall.

Kandahar is south of the major mountain massifs and north of the sandy Registan Desert and semi-desert. The foothills near Kandahar appear as if they had erupted from the plains. Between Kandahar and Spin Baldak there is a series of low rocky ridges, and (during our visit) a number of dry stream and river beds. Toward the Registan, ridges of sand and dunes (some appearing to be over 15 m. high) could be seen, often abutting the stony foothills. Along the paved highways between Kandahar and Kalat-i-Ghilzai, Spin Baldak, and Girishk the soil consists of sand and clay with a scattering of rocks—few more than 50 mm. in diameter.. The vegetation of these stony semi-deserts consists of scattered clumps of bunch grasses and shrubs, except for scrub tamarisk along the river bottoms.

Most of the irrigated land is located near the Arghandab river, including the oasis of Kandahar. There is evidence of some dry land farming.

Trap sites included: the banks of irrigation ditches, cultivated gardens, the bases of buildings including the bazaar area, talus slides on dry north- and south-facing slopes, dry shrubby banks of unused irrigation ditches, roadside gutters, and erosion gullies, the sandy semi-desert SSW of Spin Baldak, and the erosion gullies and sloping

plains of a stony desert covering a low ridge between Kandahar and Spin Baldak.

Open stands of vegetation in semi-deserts, river bottoms, sand dunes, dry washes, and rock-covered foothills were searched for nocturnal prey. While night hunting, we covered approximately 350 km. in the above terrain.

Trapping resulted in a catch of 123 specimens, hunting yielded 20, and 45 mammals were purchased including a live macaque monkey, *Macaca mulatta*, said to have been captured as a juvenile near Chigha Sarai.

Ectoparasites were collected and portions of burrow systems of *Meriones*, *Tatera*, and *Gerbillus* were excavated and examined for fleas and ticks.

13. **Girishk**

31°51′N 64°38′E; 945 m.; Nov. 10 to 14. Prevalent biotopes: Clay and loess, Sand, Watercourse, and Structure in dry, semi-desert habitat.

We camped approximately 3 km. northeast of Girishk on the bank of the Helmand River. Only terrain between 750 and 1150 m. elevation was sampled.

Collecting excursions beyond the vicinity of our main camp included trips to:

1) Qala Bist, south of Girishk.....Nov. 11, 12. A, H, L and 13. N, S.

2) Vicinity of Musa Qala, approximately 40 km. north of Girishk.....Nov. 13. A, H, L.

Temperatures were not recorded, but the weather was very similar to that of Kandahar with two notable exceptions: there was a dust storm and rain showers at Qala Bist on Nov. 11. The dust storm blew itself out in less than a day. The showers occurred intermittently over a span of eight hours.

The country around Girishk resembles, in part, that surrounding Kandahar. There are no foothills in the immediate vicinity, but hills and mountains can be seen to the north and east, the closest being approximately 35 km. to the northeast. Surrounding Girishk are semi-deserts, generally with a surface covering of small stones. Intermittent patches of sand occur between Girishk and Qala Bist. Southeast of Qala Bist what appear to be vast stretches of sand can be seen on the low bluffs east of the Helmand River. West of Girishk

pebble-desert intermixed with patches of clay or sand in shallow gullies are the dominant land features, and south, near Darweshan, a sandy desert occurs west of the Helmand River.

Vegetation is sparse and typical of the semi-desert. The oases are confined to a narrow belt along either side of the Helmand. This valley is the site of a large land reclamation program, an aspect described in detail by Michel (1959).

We set our traps in gardens and around the sparse, shrub vegetation of a pebble desert. Hunting in areas with sand, on the extensive tracts of stony deserts, and in the Helmand River bottom yielded over half of our specimens for this locality.

Traps caught 27 mammals, and hunting produced 31.

Samples of ectoparasites were taken from most of the species.

14. **Dilaram**

32°11′N 63°27′E; 854 m.; Nov. 14 to 16. H, N, S. Prevalent biotopes: Clay and loess, Rock, Watercourse, and Structure in dry, semi-desert habitat.

We stayed in the village of Dilaram. Elevations between 800 and 900 m. were sampled for bats. There were no collections of terrestrial mammals made in this locality.

Collecting respectively east and west of Dilaram was confined to two caves:

1) Koh-I-Duzdan cave, 32°13′N 63°29′E.....Nov. 15. H, N, S.
2) Sarai-Siah Ab cave, 32°12′N 62°19′E.....Nov. 15. N, S.

15. **Qala-i-Kang**

30°58′N 61°54′E; 518 m.; Nov. 16 to 20. H, N, S. 31°37′N 63°00′E; 625 m.; Nov. 20 and 21. H, N, S. Prevalent biotopes: Sand, Clay and loess, Watercourse, and Structure in dry, semi-desert habitat.

Our first camp was approximately 10 km. south of Qala-i-Kang, our second to the northeast along the Khash River. Collecting was done between 500 and 650 m. elevation within the immediate vicinity of our camps. No temperatures were recorded. Days were warm, nights cool; there was little wind and no rain.

North of our camp, and surrounding Qala-i-Kang, were the salt marshes of the Sistan basin. East and south of our camp lay pebble desert or large plains of hardpan composed chiefly of clay, and west toward Iran the ruins of numerous buildings and what appeared to

TABLE 1.—The Mammals Collected by the 1965 Street Expedition of the Field Museum to Afghanistan.

Species Collected	Number of Specimens Obtained in Each of 15 Major Collecting Localities (see fig. 24)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hemiechinus auritus	8	..	..	..	12	2	2	5	..	..	..	5	..	..	3
Paraechinus hypomelas	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..
Crocidura russula	32	2	19	2	..	..	..	..	6	5	..	..	..	..	..
Crocidura suaveolens	..	..	..	..	8	15	..	4	..	..	..	..	..	..	..
Crocidura zarudnyi	..	1	1	..	..	..	..	..	2	..	..	..	..	..	..
Suncus murinus	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..
Macaca mulatta*	..	..	..	..	..	..	..	..	..	..	..	?P	..	..	..
Ochotona rufescens	30	6	..	..	..	..	..	8	..	..	..	..	..	..	..
Lepus capensis	..	..	8	..	..	..	..	..	..	..	3	1	..	..	..
Spermophilopsis l.	..	..	..	..	4	2	12	2	..	..	..	..	..	..	..
Marmota caudata	?P	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Calomyscus bailwardi	27	26	..	..	..	3	4	8	3	12	2	2	..	..	..
Cricetulus migratorius	19	5	11	..	..	2	2	7	14	..	..	..	..	..	..
Alticola roylei	..	10	4	..	..	..	..	..	..	..	..	..	..	..	..
Microtus afghanus	28	15	..	..	..	..	..	1	1	..	..	..	..	..	..
Microtus arvalis	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..
Microtus juldashi	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..
Ellobius fuscocapillus	3		..	..	..	..	..	3	1	..	..	..	..	..	..
Ellobius talpinus	..	..	..	..	..	1	15	..	..	..	..	..	..	..	..
Gerbillus cheesmani	..	..	..	..	..	..	..	..	..	..	..	31	2	..	8
Gerbillus nanus	..	..	..	..	..	..	..	..	..	..	..	26	..	..	6
Tatera indica	..	..	..	..	..	..	..	4	..	..	7	22	1	..	2
Meriones crassus	..	..	..	..	..	..	..	..	..	..	..	22	18	..	2
Meriones libycus	18	..	..	..	59	2	..	17	27	..	12	15	..	..	1
Meriones meridianus	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..
Meriones persicus	3	21	..	..	..	..	..	10	4	..	..	7	..	..	..
Meriones zarudnyi	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..
Rhombomys opimus	..	..	..	..	12	11	11	3	..	..	..	..	..	..	..
Apodemus sylvaticus	14	..	13	..	..	..	..	8	..	1	..	..	..	..	..
Rattus rattoides	17	5	13	2	2	..	..	11	1	11	..	..	..	..	..

* Purchased specimen: P. A "P" appended to a question mark refers to specimens which ostensibly were collected beyond the indicated locality. These records are discussed in the text.

TABLE 1.—The Mammals Collected by the 1965 Street Expedition of the Field Museum to Afghanistan (*Continued*).

Species Collected	Number of Specimens Obtained in Each of 15 Major Collecting Localities (see fig. 24)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Rattus rattus	..	..	..	..	..	..	..	..	..	..	3	..	..	..	..
Mus musculus	10	6	1	3	4	5	2	2	..	11	1	18	..	..	3
Nesokia indica	1	..	..	..	11	5	11	6	..	1	5	10	9	..	6
Dryomys nitedula	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jaculus blanfordi	..	..	..	..	..	..	..	..	..	..	..	5	14	..	5
Allactaga elater	..	..	..	..	29	12	..	14	1	..	..	2	..	..	..
Allactaga hotsoni	..	..	..	..	..	..	..	..	..	..	..	..	3	..	3
Allactaga williamsi	6	1	..	..	..	..	..	..	..	..	..	..	..	..	..
Hystrix indica	1	1	..	1	..	..	..	..	..	..	..	1	..	..	..
Canis aureus	..	..	..	..	..	..	1	6	..	..	3	2	..	..	..
Canis lupus	..	..	..	..	..	..	..	?P	..	..	..	..	..	..	..
Vulpes corsac	?P	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Vulpes vulpes	..	7	1	2	4	4	2	5	..	..	3	4	3	..	2
Vormela peregusna	..	..	..	..	..	..	..	..	..	..	..	P	..	..	..
Martes flavigula	?P	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Martes foina	..	..	P	..	..	..	..	..	..	..	..	..	..	..	..
Lutra lutra	?P	..	..	..	..	..	..	?P	..	..	..	..	..	..	..
Herpestes auropunctatus	..	..	..	..	..	..	..	1	..	..	..	1	20	..	..
Hyaena hyaena	..	..	..	..	..	..	..	P	..	..	..	2	1	..	..
Felis cattus	..	2	..	..	..	..	..	1	..	..	..	..	..	..	..
Felis chaus	..	..	..	..	..	..	..	2	..	..	..	2	3	..	..
Felis lynx	..	..	..	..	..	..	..	?P	..	..	..	..	..	..	..
Felis manul	..	..	..	..	..	?P	..	?P	..	..	..	..	..	..	..
Felis uncia	?P	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gazella subgutturosa	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..
Capra falconeri	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..
Capra ibex	..	2	P	..	..	..	..	..	..	..	..	..	..	..	..
Ovis ammon	..	..	2	..	..	..	1	..	..	..	..	1	..	..	..
Chiroptera spp.**	6	5	..	..	4	4	8	1	..	5	10	7	4	4	..

** Numbers in this line refer to the number of species (not specimens) collected in each locality.

be fallow terraces were partially covered with drifting sand. Except for an occasional shrub the hardpan plains were barren. The remaining areas had scattered semi-desert or marsh vegetation.

Trap-line sites included: clay mounds and earthen remains of abandoned buildings, the edge of a marsh, the banks of an irrigation ditch, clay plains with scattered sand dunes, bunch grass covered sand dunes and a pebble desert. Night hunting was done on similar terrain.

Twenty specimens were caught in traps and 15 were captured while night hunting. We purchased additional hedgehogs and mice from the natives.

There were no bats or ectoparasites collected.

GAZETTEER

Explanation of the gazetteer is provided in text under the heading "Collecting localities and itinerary." (p. 57).

PLACE NAME	NATURAL AREA	CO-ORDINATES North Lat.	East Long.
Akcha	North	36.57	66.06
Alingar River	Nuristan, Monsoonal Afghanistan	See Fig. 2	
Amu Darya (river)	North Afghan boundary	See Fig. 2	
Andkhui	North	36.57	65.05
Anjuman Pass	Badakhshan	35.50	70.07
Baba Wali	South	31.39	65.40
Badakhshan	A natural area	See Fig. 1	
Bala Murghab	North	35.34	64.35
Balkh	North	36.46	66.50
Baluchistan		Province in W. Pakistan	
Bamiyan	Central	34.49	67.56
Basawal	Jalalabad Vale	34.13	70.53
Bash Gal River		See Bashgul R.	
Bashgul River	Monsoonal Afgh.	Kunar R. tributary	
Belchiragh	North	35.50	65.11
Bolan Cave	East	31.55	66.58
Bouean		See Bolan Cave	
Bust		See Qala Bist	
Candahar		See Kandahar	
Cave #61	Jalalabad Vale	Near Nurgul	
Central Afgh.	A natural area	See Fig. 1	
Chaman	W. Pakistan	30.55	66.27
Chamchir		See Shamshir Ghar	
Charikar	East	35.02	69.13
Chigha Sarai	Monsoonal Afgh.	34.52	71.10
Dahnar Ghar (cave)	East	34.24	69.02
Darwashan		See Darweshan	
Darweshan	South	31.02	64.08
Dilaram	South	32.11	63.27
East Afgh.	A natural area	See Fig. 1	
Eshkashem		See Ishkamish	
Faizabad	Badakhshan	37.05	70.40
Farah	South	32.23	62.08
Farindjal		See Firindjal	
Firindjal	Central	35.00	68.42
Gardez	East	33.37	69.09
Ghazni	East	33.45	68.28
Ghorband River	Central, East	See Fig. 1	
Girishk	South	31.50	64.35

PLACE NAME	NATURAL AREA	CO-ORDINATES North Lat.	East Long.
Hari Rud (river)	Central, West	See Fig. 2	
Harut River	West, South	See Fig. 2	
Helmand River	Central, South	See Fig. 2	
Herat	West	32.20	62.10
Himalayas (mountains)	East of Afgh.	Asia	

Hindu Kush Mtns. Western extension of the Himalayas in Afghanistan.

Iranian Plateau—A large plateau encompassing parts of: Iran, Baluchistan, and Afghanistan

Ishkamish	Badakhshan	36.43	71.34
Jalalabad	Jalalabad Vale	34.26	70.25
Jalalabad Vale	A natural area	See Fig. 1	
Kabul	East	34.30	69.10
Kabul River	East, Monsoonal Afgh., Jalalabad Vale	See Fig. 2 See Fig. 1	
Kalat		See Kalat-i-Ghilzai	
Kalat-i-Ghilzai	East	32.05	66.53
Kalat-us-Siraj	East	34.40	70.18
Kamdesh	Monsoonal Afghanistan	35.25	71.26
Kamu	Monsoonal Afghanistan	35.24	71.23
Kandahar	South	31.36	65.47
Kang		See Qala-i-Kang	
Kara Kum	U.S.S.R.	See Fig. 2	
Khash River	Central, South	See Fig. 2	
Khost	Monsoonal Afgh.	33.22	70.01
Koh-i-Baba Mtns.	Central	See Fig. 2	
Koh-i-Duzdan (cave)	South	32.13	63.29
Kouh Dazd		See Koh-i-Duzdan	
Kokcha River	Badakhshan	See Fig. 2	
Kunar River	Monsoonal Afgh. Jalalabad Vale	See Fig. 2 See Fig. 1	
Kunduz	North	36.47	68.51
Kunduz River	North	See Fig. 2	
Kushka	U.S.S.R.	35.14	62.15
Khyber Pass	Jalalabad Vale	34.06	71.05
Lalandar	East	34.24	69.02
Madan-Sorb Cave	Central	35.00	68.42
Maimana	North	35.54	64.43
Malik-Dokhand Mtns.	South		
Matoon		See Khost	
Matun		See Khost	
Mazar-i-sharif	North	36.43	67.05
Monsoonal Afgh.	A natural area	See Fig. 1	
Moosaqala		See Musa Qala	
Murghab		See Bala Murghab	
Musa Qala	South	32.23	69.49
Mushkichah	W. Pakistan	29.01	62.26
Nastratabad	Iran	31.01	61.30
North Afgh.	A natural area	See Fig. 1	
Northwest Afgh.	A natural area	See Fig. 1	
Nurgul	Jalalabad Vale	34.35	70.48
Nuristan	A natural area	See Fig. 1	
Oxus River		See Amu Darya	

PLACE NAME	NATURAL AREA	CO-ORDINATES North Lat.	East Long.
Paghman	East	34.36	58.56
Pamir Mtns.	U.S.S.R.	See Fig. 2	
Pamirski Post	(U.S.S.R.)	38.11	74.02
Parachinar	(W. Pakistan)	33.54	70.07
Paropamisus Mtns.	Northwest, Central, and West Afghanistan	See Fig. 2	
Pech River	Nuristan, Monsoonal Afghanistan	Kunar R. tributary	
Pul-i-Khumri	North	35.55	68.45
Qachqar Cave	Jalalabad Vale	Near Nurgul	
Qala Bist	South	31.28	64.21
Qala-i-Jadid		See Spin Baldak	
Qala-i-Kang	South	31.05	61.52
Qala Safed Ouanai Cave	East	34.30	69.00
Qal'eh Bost		See Qala Bist	
Registan Desert	South	See Fig. 2	
Safed Koh (Mtn.)	East, Monsoonal Afgh.		
Salang Pass	Central	35.24	69.08
Sarai-Siah Ab Cave	South	32.12	62.19
Sauzak Kotal (Pass)	Northwest-Central	See Fig. 2	
Scham-Schir-rohr		See Shamshir Ghar	
Shamshir Ghar (cave)	South	31.33	65.28
Sheberghan		See Shibarghan	
Shibar Pass	Central	34.55	68.18
Shibarghan	North	36.40	65.42
Shombul	Central	34.55	68.18
Sinkiang		China	
South Afgh.	A natural area	See Fig. 1	
Spin Baldak	South	31.00	66.23
Tangi-Lalandar		See Lalandar	
Tatugan		See Taliq-an	
Tadzhikistan (province)	U.S.S.R.	See Fig. 1	
Taliq-an	North	36.46	69.29
Tashgurghan	North	36.44	67.41
Termez	U.S.S.R.	37.13	67.15
Tirish Mir Mtn.	W. Pakistan	36.18	71.55
Turkmeniya (province)	U.S.S.R.	See Fig. 1	
Uzbekistan (province)	U.S.S.R.	See Fig. 1	
Wakhan	A natural area	See Fig. 1	
Wakhan Corridor	Wakhan	See Fig. 1	
West Afgh.	A natural area	See Fig. 1	
Zarmast Cave	North	35.51	64.54
Zebak	Badakhshan	36.32	71.21

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